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A research project attempted to identify and classify productive thought processes of gifted junior high school students and their teachers. Subjects were 176 gifted high achieving students of both sexes with a verbal IQ range of 127.21 to 136.35, a nonverbal IQ range of 122.88 to 134.59, and a chronological age range of 12.50 to 14.63 years. The students were given tests to determine attitudes and divergent thinking abilities and were evaluated for social qualities and class contributions by their teachers. Parents were asked to complete questionnaires independently to determine family relationships. Three judges, working as a team, tape recorded five consecutive sessions of classes in social studies, science, and English conducted by different teachers in the fall and again the following spring; all comments were classified according to levels of thinking defined in Guilford's structure of the intellect. The types of questions asked by teachers strongly influenced the quality of pupil response. More than 50% of questions asked in a class session were cognitive memory questions. The second most frequent category was convergent thinking, with a much smaller proportion of divergent and evaluative thinking questions. (BB)

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by James J. Gallagher
Mary Jane Aschner
and William Jenné

B5

Research Monograph

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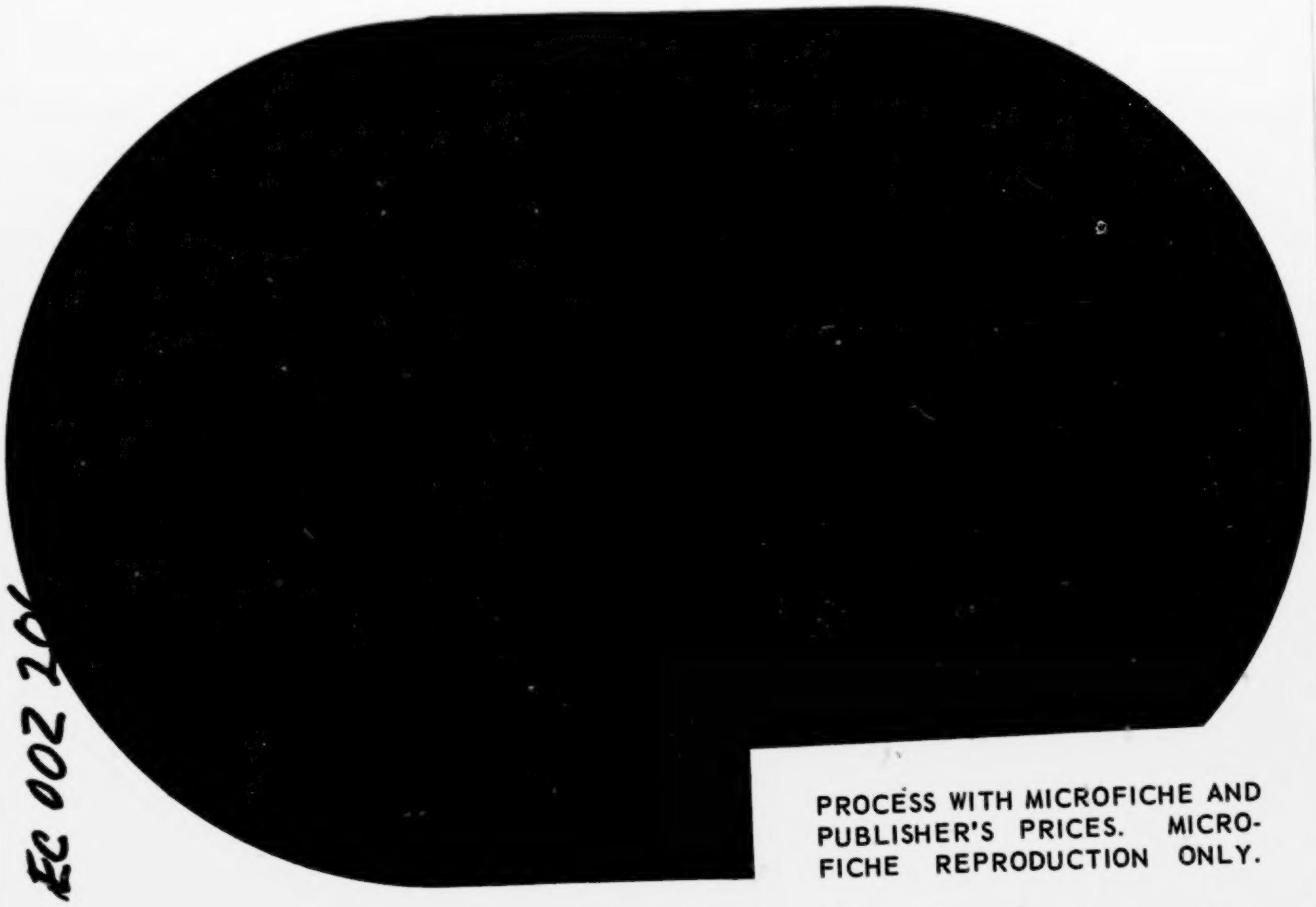

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Productive Thinking of Gifted Children in Classroom Interaction

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JJG

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1

Overview of the Study

The importance of teacher student interaction in the classroom has long been recognized, but until recently assessment of this area has been entirely the province of supervisors, ill equipped for scientific observation. The only data available consisted of unreliable personal anecdotes. Research in the social sciences has too often avoided the complexities of social setting for more precise laboratory studies.

Two important developments have changed this situation: advance in technology and changes in the theoretical approach to mental functioning. The use of tape recorders for making a permanent record of classroom interaction has provided the technical means for intensive study. The theoretical contributions of Piaget, Guilford, and others, in focusing attention on the cognitive processes, have had extensive impact on both theory and practice in the social sciences.

Objectives and Procedure

By identifying and classifying productive thought processes expressed by intellectually gifted children and their teachers, and examining relationships between these thought processes and other variables, the project described here sought specifically to determine:

1. Whether gifted children reveal distinctive individual patterns of cognitive performance.
2. Whether there is a significant relationship between the teacher's cognitive performance, and variations and patterns in the students' thought processes.
3. Whether gifted children who show a high proportion of expressive thought also obtain high scores on tests purported to measure productive thinking.
4. How attitudes and self concepts are related to the various thought patterns expressed in the classroom.
5. Whether significant differences appear among various subgroups of gifted children.

6. What relationships exist between aspects of family environment and verbal expression in the classroom.

The subjects in this study, 176 high achieving, academically talented students enrolled at the junior and senior high school level in either a university laboratory school or public school, were observed in 12 separate class sections covering social studies, science, and English. The ranges of subgroup means on age and ability were:

CA: 12.50—14.63
Verbal IQ: 127.21—134.35
Nonverbal IQ: 122.88—134.59.

There were no significant differences among groups with the exception of one group significantly lower on nonverbal IQ. Throughout the study data on girls and boys were compiled and analyzed separately.

Five consecutive one hour class sessions were tape recorded in each of the 12 classrooms, and two observers in each classroom took additional notes. No attempt was made to modify the routine classroom situation. A final typed tapescript reproduced all relevant activity, both verbal and nonverbal, as thoroughly as possible.

The students were given a battery of tests measuring both cognitive processes and personality and attitude variables. The Uses and the Consequences tests from the Guilford battery were used to measure aspects of intellectual development such as fluency and intellectual flexibility. Students were given either a modification of the Rhode-Hildreth Sentence Completion Test (Rhode, 1957) or a semantic differential scale previously used by Pierce and Bowman (1960) with a similar gifted population. In addition, results from standard measures of achievement and group intelligence tests, as well as teacher ratings, were used in the final analysis.

A family study questionnaire was mailed separately to the mother and father of each child with a request that it be completed independently of spouse. The questionnaire included data on demographic variables such as occupations, social class, and family size. Instruments used to evaluate this information included Farber's (1962) index of marital integration; a modified version of Torgoff's (1960) Developmental Timetable; and the Life Goals and Behavior Choices instruments. In order to evaluate parent-child communication, each child was asked to assess his parents' satisfaction with his behavior on a scale which paralleled some of the scales in the parents' questionnaires.

The Aschner-Gallagher Classification System (Aschner, Gallagher, Perry, Afsar, Jenné, & Faar, 1965), based on the Guilford model of the *structure of intellect*, was the instrument used to assess the different types of cognitive behavior expressed in the classroom. One focus of project staff activities was the further refinement and development of this system itself.

A principal axis factor analysis with varimax rotation was used to investigate interrelationships among variables. An analysis of variance was included to identify those factors accounting for the greatest variance in the classroom. Standard *t* tests were used to compare the subgroups within the total population, and chi squares were computed to indicate pattern deviations from chance expectation in classroom operation.

Results

Cognitive memory questions made up 50 percent or more of the questions asked by teachers in practically all sessions. The second most frequent category was convergent thinking, with a much smaller proportion of divergent and evaluative thinking questions. In some sessions, requests for divergent and evaluative thinking were entirely absent, and their presence seemed to depend upon teacher style and subject area. It would appear that almost all classroom discussions, regardless of individual teacher style, have a substantial proportion of cognitive memory and convergent thinking as necessary components.

Thought expression in teacher questions seemed to follow a different pattern from that in teacher statements.Questions appeared to represent the teacher's method of advancing class discussion and were used to elicit the desired type of response from the students, whereas statements represented the teacher's individual cognitive style. The statements remained relatively constant in style for each individual, while the types of questions varied as the subject was introduced, developed, and concluded in class. However, significant differences among the different teachers were noted in both these areas.

Each teacher's pattern of performance was observed to vary significantly from one day to another and, in some instances, from one class section to another, even when teaching identical concepts. It would be difficult to characterize a teacher's performance without indicating: (a) the particular group of students with which the teacher was working, (b) the teacher's goals for this group, and (c) the degree of class progress toward these goals at that particular time.

A close relationship was noted between the type of teacher questions asked and the pattern of thought expression observed in student responses. It was clear that character and style of verbal expression were mainly directed by the teacher.

Teacher differences were obtained over a wide range of secondary verbal expression categories, as well as on such noncognitive variables as ratio of positive to negative verdicts and expressions of humor. A close correlation was found between teacher and student performance in these areas also.

The degree of expressiveness of the individual students was significantly consistent despite changes in subject matter, teacher, and time. Contrary to preliminary expectations, individual students did not appear to specialize in any particular major thought category. Those who performed well in one category tended to be superior in all. The fact that effective performance in the classroom required use of all the major categories seemed to be responsible for this high intercorrelation.

Sex differences were obtained in degree of classroom expressiveness and general attitudes toward self and others. Boys tended to show more expressiveness in all measurable dimensions in the classroom and more confidence in their own abilities; girls appeared to be more positive in attitudes toward others and expressed a more positive attitude toward the world around them. Since written tasks reflecting cognitive ability revealed no sex differences, or in some instances superiority by the girls, this verbal superiority within the classroom may have been related more to personality and attitudinal dimensions than to cognitive ability.

IQ score did not seem to be a significant variable. It was not related to either classroom expressiveness or dimensions of attitude and personality, but it must be remembered that the IQ range in this group of gifted students was extremely limited.

Performance on divergent thinking tests was not related significantly to classroom expressiveness, but, as expected, did seem to be related to measures of self concepts and attitudes. In boys, good performance on divergent thinking tests seemed related to a degree of social independence and nonconformity; in girls, it seemed more related to a total pattern of good academic performance and personal adjustment.

An attempt was made to replicate previous work by Getzels and Jackson (1962) and Torrance (1959). Significant differences in cognitive styles were found among the high/low IQ—high/low divergent subgroups: (a) Teachers rated boys classified low IQ—high divergent less well on cognitive activities than high IQ—low divergent boys. (b) The high IQ—low divergent boys seemed to have a much less positive attitude toward the concept of work. This raised the possibility that their acceptance of the goal of academic achievement and their drive toward academic attainment (work?) was not without its cost in terms of underlying attitudes. (c) In general, the girls rated high IQ—high divergent received more favorable teacher ratings and performed more expressively in the classroom than any other subgroup of girls. This supports a general conclusion that girls who are superior in IQ and divergent thinking tasks are more self confident and more expressive in their academic performance.

In comparing students who were superior in classroom expressiveness with those inferior in expression, differences centered more in the attitudinal dimensions than in the cognitive realm.

Conclusions and Implications

Previous observations were essentially confirmed regarding the crucial role played by the teacher as the initiator and determiner of the kinds of thought processes expressed in the classroom. The individual differences obtained in this limited sample of teachers, all of whom had been rated as superior instructors, suggest that teaching styles need to be studied in greater depth to determine the impact of such styles on student performance.

While the present classification system of classroom interaction appears to be a useful first step in describing teacher and student behavior and categorizing differences, development of larger units of measurement is needed to aid in interpreting classroom strategy and interchange.

During the study, serious questions were raised about the adequacy of the Guilford model of the structure of the intellect, particularly as it related to intellectual operations. The investigators concluded that divergent thinking and convergent thinking call for similar mental operations since both demand the use of logical syllogisms. The distinctive characteristic in divergent thinking is the large number of syllogisms required.

Differences obtained between divergent and nondivergent students seem to rest in the student's attitude toward intellectual risk taking, which, in turn, is influenced by personality and attitudinal dimensions. Differences in cognitive style were obtained among various subgroups. This suggests that the way in which individuals characteristically process information received from their environment interacts with their attitudes and, to some extent, influences their classroom performance.

A question was raised in the present study as to whether or not the individual adept in performing on tests of divergent ability is, in fact, the creative thinker. As pointed out many times, creativity requires the mobilization of all kinds of thought operations, each in its proper sequence, to produce the final creative product. It appeared that some youngsters who performed well on divergent thinking tests were merely showing a lack of ability to make a critical evaluation of their own performances. Such persons not only temporarily delay evaluation, essential for allowing newly formed ideas a chance to develop, but postpone it indefinitely. They are not adept at mobilizing their scattered intellectual resources to attack a specific problem. On these grounds, teachers who rated these students less favorably than the youngsters who showed high IQ but low divergent patterns were not revealing a conformist bias so much as they were accurately reporting the lesser ability of the divergent student to focus on a given assignment.

The sex differences which pervaded the present study indicate once again that similar performance on the part of youngsters can conceal quite different patterns of motivation and attitudes. In particular, boys seem to use expressive performance as intellectual aggressiveness, whereas girls use it as part of a total pattern of academic efficiency. However, little is known about the dynamics and motivation of gifted girls, and more analysis and investigation of the personality and motivational structure of gifted girls should be undertaken.

Further work is contemplated along the lines of identifying critical incidents which shape and mold the operation of the classroom and the process by which such topics, or larger units of discussion, can be identified and classified in a broader system of cognitive processes. A new model of cognitive processes related to complex social interchange in the classroom is being developed.

The results on the family indices and questionnaires, reported in detail by Jenne (1965), were equivocal and showed no clear patterns of parental attitudes influencing child behavior. One interesting speculation by Jenne was the possibility that parents wishing to provide a fertile environment for productive thinking in their children would have to place more parental control on boys but less parental control on girls in order to compensate for current cultural biases in child rearing.

2

Background of Project

It is no doubt a historical impossibility to establish the first time someone said, "It's what the teacher does that counts." While it would be difficult to find anyone who would disagree substantially with such a statement, it is manifestly true that, before the last two decades, educational research had devoted little time to detailed study of teacher behavior or to teacher pupil interaction.

A generation of research personnel in the educational field has matured with the belief that the ideal research project is an evaluation design carefully patterned after a biological medical research paradigm. In the most careful educational research projects, the students are randomly distributed into control and experimental groups. The experimental group gets the treatment (often a new program of instruction) and the control group receives nothing or the equivalent of a placebo. During the period of the experiment, frequent measurements and reexaminations are made to chart the course and effectiveness of the treatment.

The teacher pupil interactions that were the essence of the measured "treatment" were considered equivalent to a 5 mg. pill in a medical experiment. Often, in the analysis of results, it was assumed that one pill was pretty much the same as another; i.e., that, despite any personal misgivings of the investigator, any teacher administering the educational "treatment" was pretty much the same as any other teacher.

The crucial difference between medical and educational research is that the biochemist knows in great detail what is in his pill, but the educator has little or no idea what is in his treatment pill, namely the teacher pupil interaction. As a result, the usefulness of information coming from these evaluation studies for either theoretical or practical applications has been limited, to say the least. The meager returns obtained from such extended and expensive projects have led Smith and Meux (1962) to comment:

> The failure of such studies to yield a body of consistent knowledge about instruction indicates that perhaps they are premature; that more direct and primi-

tive analyses of teaching behavior are needed as a preface to experimental and correlational studies (p. 2).

Research in Classroom Interaction

Research often follows the development of technology. Just as the invention of the microscope opened up a new world previously unavailable to research scientists, the invention and development of techniques of recording (both auditory and visual) have opened up a new world to educators.

Observational techniques have been used by forerunners of this project in attempts to understand the classroom environment (Medley & Mitzel, 1963) and study the sociology of small groups (Heyns & Lippit, 1954). Most projects have investigated variables relating to the emotional climate and control influences of the teacher on the students, an approach pioneered by the work of Anderson (1939) in his study of dominative and socially integrative behavior in the classroom. Some recent and more sophisticated efforts in this direction are represented by the work of Flanders (1960, 1963), in which an involved observational technique of interaction analysis was used not only to understand the ebb and flow of classroom processes, but also to train teachers to be aware of the influence they have in expanding or contracting the experience potential of their students.

These observational studies have made important contributions in identifying variables for further investigation, providing preliminary data on problems such as measurement of judges' reliability, and developing statistical techniques to handle the data. Nonetheless, there are some built in limitations to observational techniques that need to be considered. Medley and Mitzel (1963) suggested that the validity of behavior measurements depends on the fulfillment of three conditions:

1. A representational sample of the behaviors to be measured must be observed.
2. An accurate record of the observed behaviors must be obtained.
3. The records must be scored so as to faithfully reflect differences in behavior (p. 250).

While there are serious questions related to point 1 in most observational studies, it is point 2 that is of most concern. No matter how elaborate the observation or how many judges are involved, the essential limitation of the observation system is that only one type of behavior can be observed at any particular moment. Once that moment has passed, only that one segment of the total behavior remains as evidence of reality. Inability to re-create the essential raw data of the past situation presents an insuperable barrier to sophisticated analysis of the interaction and sequential development of concepts or the multiple interrelationships of variables operating simultaneously in the classroom.

These problems can be overcome by the use of visual and auditory recordings, which preserve the experience so that its complexities can be analyzed more fully. The advantages of this approach are shown in the increasing sophistication of the work of Smith and Meux (1962); Spaulding (1963); Taba, Levine, and Elzey (1964); Hughes (1959); Perkins (1965); Withall (1960); and Flanders (1960).

A number of investigators have tried to develop systems of cognitive behavior classification for a variety of purposes. One impressive effort is the taxonomy of education objectives described by Bloom (1956). This taxonomy was designed to enable test constructors and curriculum builders to have some common language of communication and to provide a structure through which one could examine and evaluate education programs. There are many similarities between this taxonomy and the present classification system in those categories directly related to the cognitive domain.

A complex theoretical model which also uses the concept of teacher student interaction and encompasses affective as well as cognitive domains has been proposed by Ryans (1960, 1963). This model has incorporated computer terms such as information processing and feedback as key concepts.

Gage (1963a,b) has provided a useful summary of a variety of paradigms or models in current usage in the study of the teaching process. Which of these models is most useful will be decided by the amount of research generated and the number of fruitful hypotheses derived from each.

Research in Cognitive Processes

In comparison to the development of research in the areas of attitude and personality, which received great attention in psychological circles following World War II, interest in cognitive development and processes has languished. Complex thought processes have either been ignored or dismissed as being adequately measured by intelligence test scores. The idea that intelligence is what an intelligence test measures has been followed in such practical matters as the definition of mentally retarded and intellectually gifted children. The few highly specialized laboratory studies on complex thought processes have not been much help in expanding concepts.

Gallagher (1964a) noted four major differences between the laboratory tasks and those encountered in the more normal learning environment of the individual (Table 1). In a real life situation, a problem must be

TABLE 1

Differences between Laboratory Exercises and Reality in Use of Productive Thinking[a]

Laboratory	*Reality*
Problem selected for subject	Problem must be chosen from many other stimuli competing for attention of the subject
Extraneous stimuli reduced or systematically introduced	Extraneous pressures and distractions randomly presented
Problem chosen so it can be solved in a short period of time	Difficult problems often extend for weeks and months before solution
Emotional involvement limited	Emotional involvement often severe, affecting self-status, livelihood, family, professional career, etc.

---

[a] From Gallagher, 1964b, p. 353.

selected by the individual from among many, whereas in the laboratory, the problem has already been selected for the subject. In a normal setting, extraneous pressures and distractions impinge upon the person trying to solve complex problems, but in the laboratory, extraneous stimuli are reduced or systematically introduced. In reality, difficult problems demanding complex thoughts often extend over weeks or months, whereas the laboratory problem must be chosen in such a way that it can be solved within a short period of time. Finally, and perhaps more important, the experimental task is often an inadequate sample of the construct being investigated. Is a conditioned eye blink really isomorphic to the construct of anxiety? Is the inability to solve the water jar problem isomorphic to rigidity? Is the ability to find many uses for a brick really isomorphic to creativity? It is in this area that results of laboratory studies should receive strictest scrutiny.

The failure of the laboratory task to come to grips with more important constructs has been reflected in the comments of reviewers. Corman (1958) commented, "Problem solving meant the behaviors that researchers, who say that they are studying problem solving, study" (p. 459). Duncan (1959) made the following summary statement:

> The field of problem solving is poorly integrated. The reasons for this seem to be the use of a great variety of tasks to provide problems, the frequent use of unanalyzed and nondimensionalized variables, the lack of agreed upon taxonomy, and, to some extent, the failure to relate data to other data or theory (p. 426).

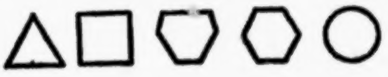
Two established trends bring hope for a more meaningful and systematic approach to complex thought processes. One is represented by the work of Piaget, the Swiss psychologist whose intensive case history studies of children's thinking abilities have finally made a definite impact on American education and psychology. The second trend is represented by the work of Guilford, who developed a comprehensive picture of intellectual processes and operations. While these approaches differ quite strikingly, both provide a rather comprehensive model of the cognitive processes and allow for the development of testable hypotheses which may eventually build a picture of complex thought development and operation.

Guilford's early interest in creativity (1950a) seemed to play a large role in the development of his now familiar structure of intellect (See Figure 1 on page 18). He divides the intellect into three major dimensions: content, operations, and products. The subcategories of these three dimensions are:

Content	*Operations*	*Products*
Figural	Cognition	Units
Symbolic	Memory	Relations
Semantic	Divergent Thinking	Classes
Behavioral	Convergent Thinking	Implications
	Evaluation	Transformations
		Systems

Guilford's factor analytic research concentrated on the discovery of tasks that could measure all possible combinations of content, operations, and products. For example, the tasks listed below contain the same operations (cognition) and the same products (classes) but vary in content (Gallagher, 1964b, p. 178).

Which one does not belong?



(Figural)

Chair, Sofa, Table, Bed, Refrigerator (Semantic)

25, 49, 81, 14, 64 (Symbolic)

Guilford's model, which has undergone progressive revision with new evidence (1959, 1966), has the attractive feature of including many thought processes and operations that did not seem to be covered by the usual intelligence test. For instance, intelligence tests have few items that call for divergent thinking, originality, flexibility, etc. Even so, it would seem likely that such a model would have more theoretical interest than practical application except for the fact that some of Guilford's tests have been used in educational experiments that obtained seemingly important results.

One of the most influential of the studies using these new concepts was that conducted by Getzels and Jackson (1962), who distinguished between what they called "high creative" and "high IQ" adolescents. The high creative students were those who performed well on divergent thinking tasks but were not within the top 20 percent on IQ scores; the high IQ group had IQ scores in the top 20 percent but lower scores for divergent thinking. Differences were found between these groups in teacher rating, personality, self concept, and cognitive style. They stated, "One focuses on what is already discovered, the other focuses on what has yet to be known" (p. 14). Although this study has received virulently critical reviews because of a number of methodological errors (see, for example, Thorndike, 1963), it still contains many rich ideas and concepts.

There has been a continued flow of research on the cognitive style first noted by Getzels and Jackson (1962) and Torrance (1959). Reviews by Maccoby (1964) and Gallagher (1964b) have pointed out the confused and contradictory evidence available at this writing. Other observers have noted the similarity between the dichotomy of students noted above and similar divisions by Witkin, Dyk, Paterson, Goodenough, and Karp (1962)—field independent and field dependent; Schachtel (1959)—allocentric and autocentric; and Maslow (1959)—growth and defense. Such research has revealed the potential of the Guilford conceptual system for application to an educational setting.

3

Objectives and Methods

This project sought to (a) identify productive thought processes in intellectually gifted children within the context of classroom verbal activity at the junior high school level, and (b) assess relationships between these thought processes and certain variables that may relate to their operation in the classroom. Specific objectives were:

1. To apply a classification system to the classroom verbal interaction of intellectually gifted children in order to tabulate productive thought occurrences and to examine the following propositions:
   (a) That children will differ significantly in their patterns of classroom verbal behavior in divergent, convergent, and evaluative thought processes;
   (b) That variations in the teacher's verbal activities will relate significantly to variations in patterns of thought processes evidenced in his students;
   (c) That verbal behavior in classes of gifted children will show certain identifiable patterns and sequences, regardless of course content or type of school.
2. To relate manifestations of productive thinking in classroom verbal interaction of gifted children to other evidence, e.g., scores on tests of productive thinking.
3. To correlate measured differences in classroom verbal activities of gifted children with measured differences in attitudes, self concepts, and other variables presumably related to intellectual productivity, in order to test the following hypotheses:
   (a) A low level of productive thinking in classroom verbal activities will be associated with negative attitudes toward work, school, and society:
   (b) Frequency and quality of verbalization in class discussion will relate significantly to self and self ideal concepts (e. g., girls may talk less than boys because of differences in perceived role behavior).

Subjects

The 176 subjects in the present study were all academically talented students enrolled at the junior and senior high school level in either a university laboratory school or a public school. The selection of students for participation in this study was based on the fact that they happened to be attending the class sessions in social studies, science, and English which were tape recorded.

The study covered five teachers, each of whom had two sections of students in the same subject area. The paired arrangement of the groups, e.g., BAKER-CHARLIE, was used to indicate different sections taught by the same teacher.

The BAKER-CHARLIE and HAT-IDEA groups represented almost the entire subfreshman class (combined 7th-8th grade) at University High School, University of Illinois. Students are admitted to this school on the basis of performance on the Lorge-Thorndike Group Intelligence Test, Cooperative Achievement Tests, past academic records, and teacher recommendations. The DAN-EASY groups represented two sections of a freshman science class in the same school, with the recordings taken one year later. The public school students in the study were in the FOX-GEORGE and JACK-KING groups. These students had been placed in accelerated science and English classes because of high scores on intelligence and achievement tests and evidence of past academic efficiency.

Table 2 indicates by sex the means and standard deviations of intelligence test scores and chronological age for each group. Each teacher had two sections of students in substantially the same subject area. The

TABLE 2

Chronological Age and Ability Level of Students by Group and Sex

	Age in Months			*Verbal IQ*		*Nonverbal IQ*	
	N	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
Boys							
BAKER-CHARLIE	23	145.87	4.35	130.96	9.12	128.09	10.69
DAN-EASY	15	166.53	8.20	130.13	7.19	128.80	10.79
FOX-GEORGE	29	159.86	3.61	131.17	6.87	134.59	10.28
HAT-IDEA	25	148.32	3.90	133.12	11.10	131.32	7.82
JACK-KING	26	175.54	3.54	129.73	9.93	132.54	9.85
Girls							
BAKER-CHARLIE	20	145.35	4.72	134.35	10.77	128.00	12.63
DAN-EASY	20	167.05	9.17	132.20	10.83	125.30	14.84
FOX-GEORGE	32	159.59	3.98	128.97	8.31	131.72	10.49
HAT-IDEA	17	149.47	4.08	127.24	9.07	122.88	8.45
JACK-KING	28	175.11	4.29	127.21	9.76	130.54	11.40

groups ranged in age from 12 to 15 years. The high standard deviation in CA in DAN-EASY was due to the fact that some members of the group had been previously accelerated.

The verbal and nonverbal IQ scores of the different groups were similar. The classes in this study can be considered groups of gifted students, since the mean verbal IQ of all the groups would place these students in about the top 2 percent of the general population. Since these were group IQ test scores they were probably an underestimation of what the students would score on individual intelligence tests. Where both group and individual IQ test results were available, the group IQ test scores were almost always below those obtained on the individual measures, due to the lower ceiling on group intelligence tests.

As measured by these tests, there did not seem to be any meaningful differences in ability between the boys and the girls, with the inexplicable exception of the nonverbal IQ scores in the HAT-IDEA group in which the boys appeared to be superior. With this single exception, the sexes seemed reasonably well matched in terms of mental growth in both the verbal and nonverbal areas, both within the individual groups and across the total study population.

Data Collection

The collection of data that would provide a faithful reproduction of classroom interaction presented a number of technical difficulties. The goal was to tape record 12 classes of intellectually superior children of junior high school age; the subjects covered were social studies, science, and English. In order to obtain a reasonable sample of classroom performance, it was decided to record five consecutive sessions of each class. Previous observations had indicated that one classroom session alone might not represent typical performance of either teacher or students, and, since many topics extend over more than one class session, it was felt that assignments or discussion topics could only be observed by recording an entire school week.

Table 3 indicates the classes that were tape recorded for analysis, a total of ten different classes with five teachers. The classes called BAKER and CHARLIE were tape recorded for five consecutive sessions in the fall and again for five consecutive sessions in the spring of the same school year in order to examine the performance of the same students in the same subject with the same teacher but with an interval of five months. Although the small number of teachers and classrooms make any generalization extremely tentative, it was hoped that some interesting hypotheses might be generated.

Another goal of the study was to look at the same students in different

TABLE 3

Classes Tape Recorded for Five Consecutive Sessions for Analysis of Productive Thinking

Class Designation	*Subject Matter*	*Level*
BAKER-CHARLIE	Social Studies (Fall and Spring)	University High School Subfreshman Grades 7 and 8 Combined
DAN-EASY	Science	University High School Freshman
FOX-GEORGE	Science	Urbana High School Grade 9
HAT-IDEA	Social Studies	University High School Subfreshman Grades 7 and 8 Combined
JACK-KING	English	Urbana High School Grade 10

subject matter classes. Many of the students in BAKER and CHARLIE were also in DAN and EASY with a different teacher and a switch from social studies to science. In addition, many students recorded in their 9th grade science classes, FOX and GEORGE, were recorded one year later as members of the English classes, JACK and KING. Thus, similarities and differences in student patterns could be observed with different subject matter and teacher.

Another source of comparison was the fact that groups HAT and IDEA covered the same subject matter as BAKER and CHARLIE at the same school at the same level but with another teacher. In addition, since each teacher had two different classes covering almost identical subject matter, it was possible to compare his performance with two different groups of students.

The seating arrangement was kept the same as in the regular class meetings. Sound was picked up from three standing microphones, directed through a mixer, and finally into the tape recorder. Under ordinary circumstances, three members of the project staff were in the classroom during recording. One of the three persons operated the tape recorder and mixer, and the other two generally sat in the corners behind the students in positions where they could note who was speaking as well as any nonverbal information pertinent to the project. These observers tried to keep a running account of the sequence of speakers in order to identify the students on the tape recording, and they reproduced blackboard material or drew diagrams of experimental demonstrations, etc. They reported affect or emotional tone such as sarcasm, wit, or intended humor. Two observers were used in order to check accuracy of student identification and pick up student by-play or unusual happenings in different parts of the room.

Transforming the original tape recording into a tapescript for analysis was one of the most time consuming tasks in this project. The following sequence represents the tasks involved in this transformation:

1. The tape recording and observer notes were given to a secretary who typed a rough copy.
2. The typed draft was given to the first auditor who was (when possible) one of the classroom observers at the time of the recording. This auditor made modifications, which were often considerable, on the rough draft while listening to the original tape.
3. The modified draft was then given to a second auditor (when possible, the second observer), who again listened to the tape while following the modified script with observer notes.
4. The twice modified script was given to an editor, who prepared it in format for typing.
5. The secretary then typed a ditto master and ran off copies to be used for analysis.

It is the considered judgment of the staff on this project that until there is definite progress made in electronics, alternatives to tape recording need to be seriously considered in doing research of the type in the present project. Even under excellent sound conditions young children do not make the best recording subjects. They are restless, move around, and are often hard to understand. One alternative considered by the project staff has been the possibility of employing a stenotypist to sit in the class and provide a record of transactions. The tape recordings obtained from the class sessions in the present study were not of sufficiently good quality to use for teaching purposes, despite the cost of untold hours of staff listening time and secretarial help.

Classification System

It is no disservice to those who have studied the classroom environment, such as Aschner (1960), Flanders (1960), Smith (1960), Spaulding (1963), and Taba et al. (1964), to suggest that we are still in the beginning stages of understanding the process of classroom interaction. Indeed, as Smith (1961) commented,

> Our knowledge of the act of teaching as well as that of taking instruction is meager. Neither of these acts has been investigated sufficiently to justify from a scientific standpoint, fundamental changes in teaching . . . the act of teach-

ing has received far less attention than its central role in pedagogy would seem to require (pp. 93-94).

One of the major prerequisites to an effective analysis of teacher pupil interaction is some theoretical structure or model by means of which one can organize the complex data. A good list of available models is given by Gage (1963b). At the time the present research project began there was much interest in the theoretical contributions of Guilford (1956, 1959, 1966) and his structure of intellect. Theoretical aspects of the project were highly influenced by his contributions, not only in the classification system but also in the choice of measuring instruments.

Guilford's model of intellectual performance was developed through a series of sequential studies employing factor analytic methodology. From these he derived the well known model shown in Figure 1. The Aschner-Gallagher Classification System (Aschner et al., 1965), used in this project, was developed from this model. Of the three major dimensions of Guilford's model, this study was most concerned with opera-

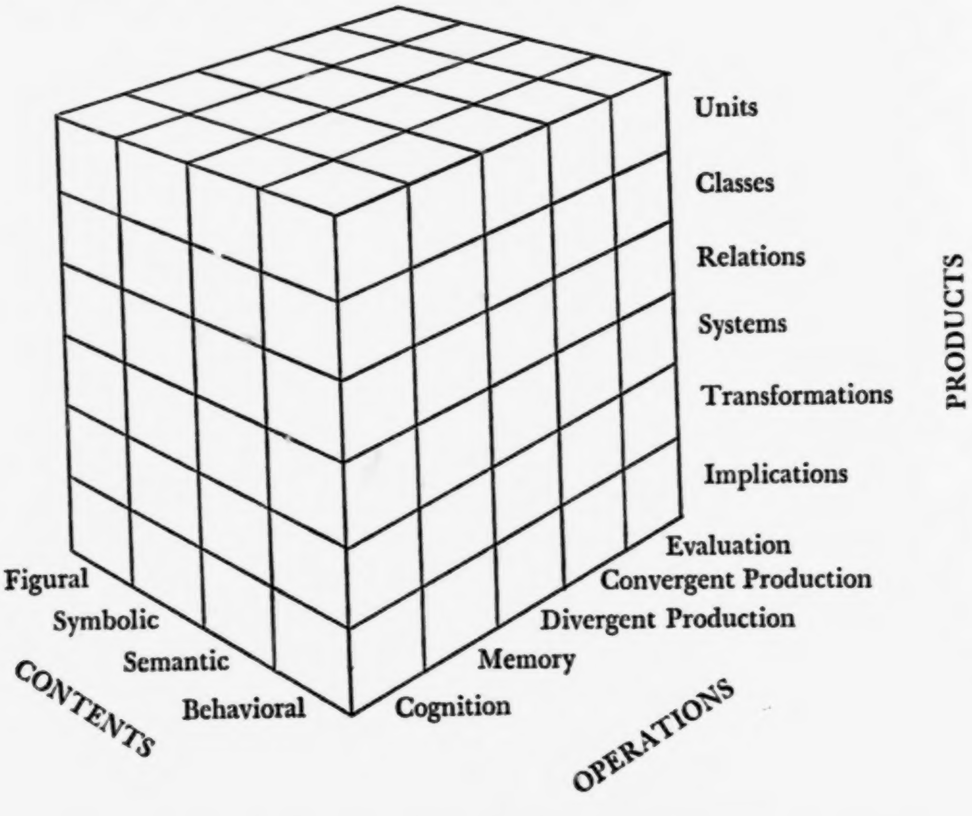

Units
Classes
Relations
Systems
Transformations
Implications
PRODUCTS
Evaluation
Convergent Production
Divergent Production
Memory
Cognition
OPERATIONS
Figural
Symbolic
Semantic
Behavioral
CONTENTS

Figure 1. Theoretical Model for the Complete Structure of Intellect (Guilford, 1959)

tions. Thus, the primary classification categories in the present study were cognitive memory (CM); convergent thinking (CT); divergent thinking (DT); evaluative thinking (ET); and routine (R). A brief description of each area follows:

1. *Cognitive memory* represents the simple reproduction of facts, formulae, or other items of remembered content through such processes as recognition, rote memory, and selective recall. (Although Guilford separates cognition and memory in his model, they are combined here because of the difficulty in differentiating them in class interaction and because both represent, from our point of view, nonproductive thinking operations.) Examples of cognitive memory performance can be seen in the following:

   T: What planet is closest to the sun?
   Bill: Mercury, and it doesn't rotate either.
   T: What were some of the main points covered in our discussion about mercantilism?
   Mary: One of the things we learned was that there was an attempt to keep a favorable balance of trade.
   T: Does anybody remember who was the sixteenth President of the United States?
   Bob: Abraham Lincoln.

   These teacher student interchanges do not require the student to integrate or associate facts; the questions can be handled by direct reference to the memory bank and selection of the appropriate response from a store of remembered items. While factual information is indispensable to the development of higher thought processes, it is a sterile and uninteresting class which never moves into the challenge and excitement of more complex operations.

2. *Convergent thinking* represents the analysis and integration of given or remembered data. It leads to one expected end result or answer because of the tightly structured framework through which the individual must respond. Some examples of convergent thinking follow.

   T: If I had 29 cents and gave John 7 cents, how much money would I have left?
   Bob: Twenty-two cents.
   T: Can you sum up in one sentence what you think was the main idea in Paton's novel, *Cry The Beloved Country*?
   Pete: That the problem of the blacks and the whites in Africa can only be solved by brotherly love; there is no other way.

Thus, convergent thinking may be used in solving a problem, summarizing a body of material, or establishing a logical sequence of ideas or premises—as, for example, in reporting the way in which a machine works, or describing the sequence of steps necessary for passage of a bill through Congress.

3. *Divergent thinking* represents intellectual operations wherein the individual is free to generate his own ideas within a data-poor situation, or to take a new direction or perspective on a given topic. Some examples of divergent thinking are:

T: Suppose Spain had not been defeated when the Armada was destroyed in 1588 but that, instead, Spain had conquered England. What would the world be like today if that had happened?
Sam: Well, we would all be speaking Spanish.
Peg: We might have fought a revolutionary war against Spain instead of England.
Tom: We might have a state religion in this country.

These examples represent teacher stimulated divergent thinking, but it need not always be teacher generated. In a discussion of the spoils system a student may generate the following:

Pete: Well sure, the spoils system might be a good thing when a political party is getting started, but what about when there's no party system—like in the United Nations?

Here the student reveals his ability to take off from an established fact or facts and see further implications or unique associations that have not been requested, or perhaps even thought of, by the teacher. Instances of self initiated student behavior would also fall under the general category of divergent thinking.

4. *Evaluative thinking* deals with matters of judgment, value, and choice, and is characterized by its judgmental quality. For example:

T: What do you think of Captain Ahab as a heroic figure in Moby Dick?
Bob: Well, he was sure brave, but I think he was kind of mean the way he drove the men just because he had this crazy notion of getting back at Moby Dick.
T: Is it likely that we will have a hard winter?
Mary: Well, I think that the pattern of high pressure areas suggests that we will.

In the first example the student is asked to construct his own value dimension, what he considers heroic, and then to make a judgment as to where he would place Captain Ahab. In the second response, the student is asked to give a speculative opinion or assessment of probability. A third possibility, not illustrated here, involves entering a qualification or disagreement which modifies a prior judgment by another student, or stating a counter judgment which directly opposes the statement of the previous speaker.

5. *Routine* includes procedural matters such as management of the classroom, structuring of class discussion, and approval or disapproval of an idea or person. Included here are the attitudinal dimensions of praise or censure of others or of self, as well as dimensions of structuring, such as prefatory remarks about what the speaker intends to say or do, or what he expects someone else to say or do. Other characteristic occurrences—humor, ordinary routine classroom management behaviors such as requests to close the door—are included in this general category.

Secondary categories within the classification system were derived empirically by studying the classroom performance of students and teachers. Examples that seemed to differentiate certain behaviors from other types of behaviors were extracted, appropriately labeled, and classified under the prime categories. The final organization of the secondary categories is presented in Table 4.

The evolution of the secondary categories involved two major steps. During the initial stage, project members concentrated on detecting behavior which did not seem to fit into the established categories. These behaviors, if they seemed important enough, were made into new categories, given distinctive definitions, and placed under the appropriate primary category. This approach, while interesting and instructive to the staff in terms of how many intellectual variations could be obtained in a classroom setting, became unmanageable from the standpoint of obtaining consistent ratings by judges. Distinctions became too fine. It appeared, upon further consideration, that clear distinctions could be made between various cognitive performances without such distinctions having important psychological or sociological meaning.

Thus, the second major step was to condense and eliminate a number of categories that did not seem useful for the final analysis. For example, several categories had been developed such as Cla (clarification of a previous statement by adding a bit of new information) and Clm (clarification of a previous statement by restating already given information). Since this fine distinction did not seem to have important meaning in pedagogy, the two categories were condensed into one general category (Cl). The final classification system was reduced by approximately 25 percent from the high water mark of categories before the final analysis was carried out.

TABLE 4

Secondary Classification Categories

I. Routine (R)

This category includes routine classroom procedural matters such as management of the classroom, the structuring of class discussion, and approval or disapproval of the idea or the person.

Management

Mq	Question: Requests or invitations to speak; calling for questions, as, "Anybody have a question?"
Mp	Procedure: Announcements or procedural instructions, given or requested for individuals or the group as a whole.
Ma	Aside: Incidental or parenthetical comment; gratuitous content.
Mnc	Nose Counting: Calling for or responding with a show of hands for a tally or canvas.
Mfb	Feedback: Request for or response with signs from group as to whether or not the speaker's actions or remarks are clearly understood.
Mw	Work: Nonverbal actions or seatwork going on in connection with current discussion or class proceedings.
X	Response unclassifiable primarily due to technical recording difficulties.

Structuring

Sts	Self Structuring: Conventional prefatory move to signal content and purpose of one's own next remarks or behavior.
Sto	Structuring Other(s): Engineering next speech or actions of other(s). Monitoring other's performance. Pump priming to keep discussion going on a point already before the class.
Stf	Future Structuring: Forecast of future activity, study, learning, etc., beyond this particular class session.
Stc	Class Structuring: Focusing class attention on point to be emphasized or taken up; laying groundwork for question or problem; probing, pushing, adding data for bogged down class (teacher only).

Verdict

Ver	Verdict: (+ or —) Impersonal praise or reproach on quality of academic performance of individual or group.
Verp	Personal Verdict: (+ or —) Personal praise or reproach of individual (occasionally by T on whole class). Negative Verp generally on deportment.
S	Agreement: (+ or —) Acceptance or rejection of content; conceding a point; *not* permission giving or procedural.
Agr	Self Reference: Speaker's personal report or comment upon or about self. Often conventional device; cautionary tactic.
Du	Dunno: Explicit indication that one does not know.
Mu	Muddled: Speaker confused, mixed up, flustered.
Hu	Humor: Remark of evident witty, humorous, or comic intent; response (usually laughter) to same.

II. Cognitive Memory (CM)

CM operations represent the simple reproduction of facts, formulas, and other items of remembered content through use of such processes as recognition, rote memory, and selective recall.

TABLE 4—continued

Scr	Scribe: Giving a spoken or written spelling or exemplification of a work or expression.

Recapitulation

Req	Quoting: Rote recitation or literal reading from text, paper, or notes in hand.
Rep	Repetition: Literal or nearly verbatim restatement of something just said.
Rec	Recounting: Narration of past extraclass occurrence.
Rev	Review: Recitation of material which occurred or was discussed in current or past class session.

Clarification

Clm	Clarifying Meaning: Rendering a previous statement more intelligible either by (a) restating or rephrasing or (b) adding informative details.
Clq	Clarifying Qualification: Rendering a previous statement more accurate either by (a) entering a rider upon the remark or (b) entering an explicit correction.

Factual

Fs	Fact Stating: Requests for and recitations of items taken to be matters of fact.
Fd	Fact Detailing: Spinning out further a prior assertion of fact or other statements (As, Exr) in which factual items were mentioned.
Fm	Factual Monologue: Reporting of factual material in the form of a monologue during which verbal exchange is conventionally excluded.

III. Convergent Thinking (CT)

Convergent thinking is thought operation involving the analysis and integration of given or remembered data. It leads to one expected result because of the tightly structured framework which limits it.

Translation

Tr	Translation: Shift of conceptual material from symbolic or figural content to semantic, or vice versa.

Association

As	Association: Involving likenesses and differences; degrees of comparison; and relationships of direction, spatial position and/or classification, etc.

Explanation

Exr	Rational Explanation: Asking or telling why X is the case; why Y caused X, etc. Substantiating a claim or conclusion by citing evidence.
Exv	Value Explanation: Asking or telling why X is good, bad, useful, important, etc. Justifying a rating, viewpoint, or value based judgment by giving reasons why.
Exn	Narrative Explanation: Step by step account of how something is done, how a mechanism works, or what led up to an event or given outcome.

Conclusion

Gen	Generalization: Integration of prior remarks by slightly more general reformulation.

TABLE 4—continued

Cons	Summary Conclusion: Summary reformulation, often serial or enumerative, of material treated in discussion or reading.
Conl	Logical Conclusion: Calling for a deductively drawn implication from material presented.

IV. Evalutive Thinking (ET)

Evaluative thinking deals with matters of value rather than matters of fact and is characterized in verbal performance by its judgmental character.

Unstructured

Ura	Unstructured Rating: A value judgment produced or requested on some idea or item in terms of a scale of values provided by the respondent.
Uju	Unstructured Judgment: A value judgment produced or requested on some idea or item wherein the value dimension has already been provided.

Structured

Svp	Structured Probability: An estimate or speculative opinion is given or requested as to the likelihood of some occurrence or situation.
Svc	Structured Choice: Speaker calls for or declares his position as a choice between alternatives (not between yes or no answers).

Qualification

Qj	Qualified Judgment: An offer or request for a rider or modification to a prior value judgment. Also, attempts to make more precise the value dimension discussed.
Qc	Counter Judgment: Speaker declares a directly opposed position with respect to value statement of a previous classroom speaker.

V. Divergent Thinking (DT)

In a divergent thinking sequence, individuals are free to generate their own ideas independently within a data poor situation, often taking a new direction or perspective.

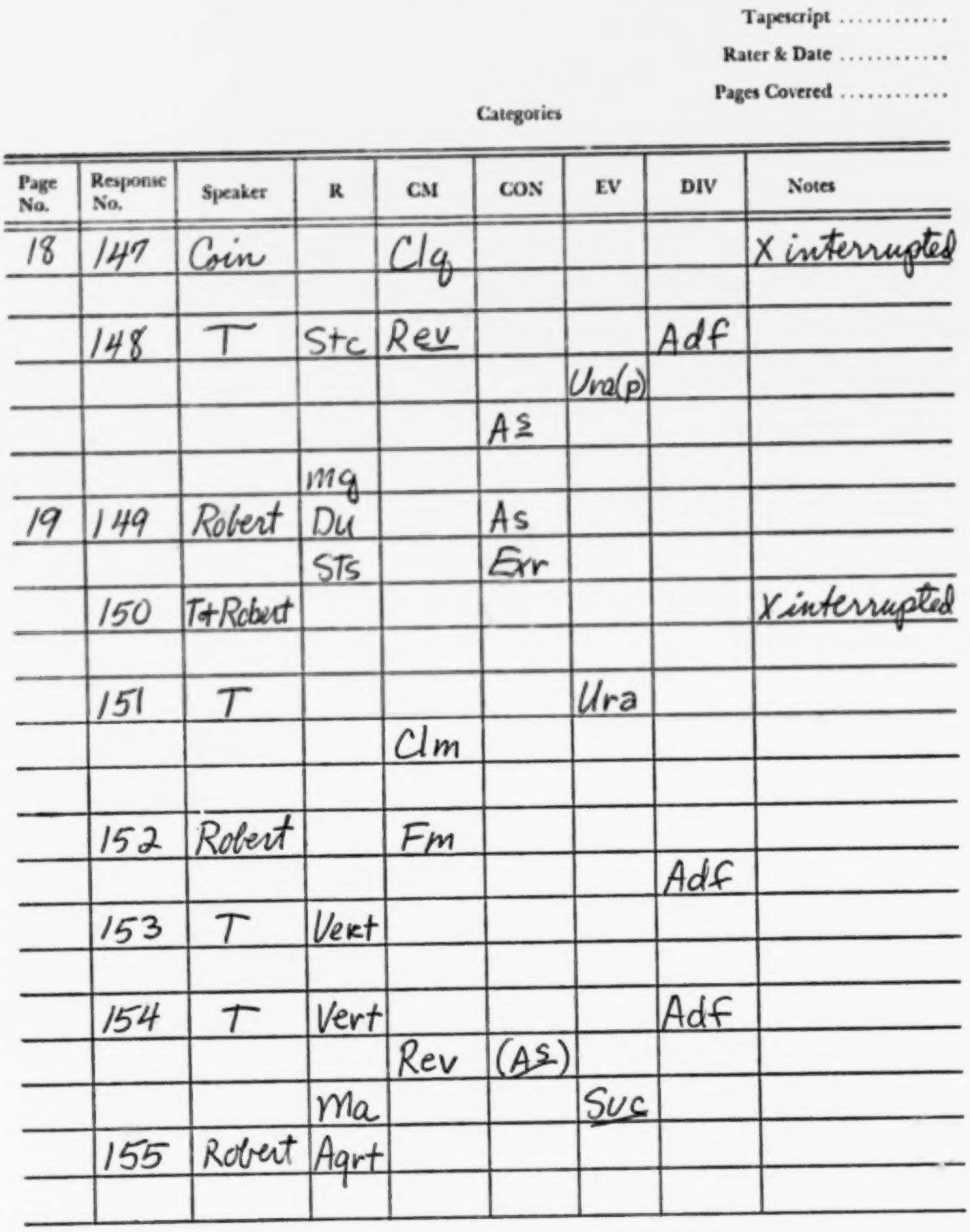
El	Elaboration—Structured or free (s or f): Building upon a point already made; filling out or developing a point, but not shifting to a new point, often by concocting instances or examples.
Ad	Divergent Association (s or f): Constructing a relationship between ideas, casting the central idea into sharper and often unexpected perspective, by comparisons, analogies, etc.
Imp	Implication (s or f): Extrapolation beyond the given; projection from given data—typically by antecedent—consequent or hypothetical construction—to new point(s) of possibility.
Syn	Synthesis: Spontaneous performance, tying in, integrating the current central idea with an entirely new point or frame of reference. May be a variation or reversal of a previous conclusion.

Double Paired Ratings: The complex nature of verbal classroom interaction often required the combination of more than one of the above described categories.

Note.—The full classification system and instructions are presented in Aschner, et al., 1965.

Figure 2 gives a sample of the flow chart used in the current project to classify thought processes. Each class session of approximately one hour produced 30 to 50 pages of double spaced manuscript, and each flowchart covered about one page of that transcript.

The particular flowchart in Figure 2 covers part of a social studies class, HAT 1. The subject under discussion was the resistance of natives



Tapescript ....

Rater & Date ....

Pages Covered ....

Categories

Page No.	Response No.	Speaker	R	CM	CON	EV	DIV	Notes
18	147	Coin		Clq				X interrupted
	148	T	Stc	Rev			Adf	
						Ura(p)		
					As			
			mg					
19	149	Robert	Du		As			
			Sts		Exr			
	150	T+Robert						X interrupted
	151	T				Ura		
				Clm				
	152	Robert		Fm				
							Adf	
	153	T	Vert					
	154	T	Vert				Adf	
				Rev	(As)			
			Ma			Suc		
	155	Robert	Aqrt					

Figure 2. Sample Page of Classification Flowchart (from HAT 1 Session)

to colonization of this land. Response No. 147 by Coin was a clarifying qualification (Clq) correcting a previous statement by the teacher. Response No. 148 included a wide variety of teacher behavior: the teacher structured (Stc) the class as to what would be discussed next; asked for review (Rev) of information on an area previously studied; made a unique divergent association (Adf) of his own; made a rating (Ura) on how well the class was doing on their assignment; and ended by asking for a convergent association (As). Robert, in response No. 149 to the teacher's question, stated that he did not know (Du), announced what he was going to talk about (Sts), gave a convergent association (As), and followed with an explanation for his previously given association (Exr). In statement No. 151, the teacher gave an evaluative rating of his own (Ura) and clarified the previous statement made by Robert (Clm). In No. 152, Robert launched into a factual monologue (Fm), punctuated by a divergent association (Adf). The teacher expressed praise in a positive verdict on Robert's performance (Ver), gave a divergent association himself (Adf), repeated the association question in statement No. 148 (Rev), and finally asked the students to make a decision—an evaluative choice between two alternatives that he presented (Svc).

After becoming familiar with the category system it was possible to follow the tapescript flowchart and have a reasonably good idea what was being discussed and how, without looking at the tapescript itself.

To evaluate the reliability of the classification system it is necessary to list briefly the classification procedures:

1. A tapescript was given to two members of the project staff, who independently classified each teacher and student statement on a flow chart.
2. The two staff members then compared their ratings and tried to reach a consensus on any classification discrepancies. In many instances this was relatively easy because one judge could see that he had overlooked an obvious point. One of the unresolved problems was the establishment of a set in all the judges which tended to result in bias, leading to over- or underrepresentation of certain classification categories. The consensus meeting was extremely important to counteract such sets.
3. In those few cases where the judges could not reach agreement, the full project staff (five to seven persons) decided on the classification.

Consensus of individual judges would appear to stabilize the judgment to some extent, but there still remained a possibility that one judge with a strong personality or a particular point of view could sway the judgment of the larger group when discussing particularly difficult rat-

TABLE 5

Percentage of Agreement by Two Consensus Teams Classifying One Session of IDEA 3

Category	Team One N	Team One Percentage	Team Two N	Team Two Percentage
Cognitive Memory	126	62	132	58
Convergent Thinking	29	14	38	17
Divergent Thinking	20	10	17	7
Evaluative Thinking	29	14	42	18
Totals	204	100	229	100

Total Statements Rated—296
Total Agreement—231
Percentage of Agreement—78

ings. To illustrate the degree of consistency of the classification system, one class session, IDEA 3, was selected because of the range of ideas present. Two teams, operating independently, classified the entire session; team judgments were then compared as shown in Table 5. The two teams gave essentially the same percentage allotment to the major categories. Team 1 rated 62 percent of the total responses as cognitive memory whereas Team 2 rated 58 percent of the items as cognitive memory; Team 1 rated 14 percent of the items convergent thinking and Team 2 rated 17 percent of the items convergent thinking.

It may be noted that the total number of ratings in the cognitive memory area differed between the two teams. Team 2 apparently divided the statements into finer subcategories than Team 1. An example of such a rating can be seen in the following teacher statement:

> T: All right. Now, does this present—if this is the case, then (several words inaudible) what we put on the board we should all consider tentative, that is, not final—because you probably gained this information from a single source and there are many reasons why a single source of information may not be accurate. It may be your interpretation of it—that—which another —going to another source might clear up or it may be that—simply that the particular book that you are using is not accurate. Now, let me ask, what kind of problem this could present, possibly, to the colonists—if the House of Burgesses—if the members of the House of Burgesses were elected by the Supreme Council in London. What kind of thing might you have? Leland?

Consensus Team 1 saw in this statement structuring of the class (Stc), rational explanation (Exr), and a request for implications (Imps). Team 2 agreed with all of the categories seen by Team 1 but, in addition, saw a pedagogical rating (Urap) by the teacher. Thus, Team 2 had four ratings for this one statement, whereas Team 1 had only three. Similar minor differences would result in the different totals shown in Table 5.

Of the 296 statements made by teachers and students, total agreement was obtained on 231, or 78 percent. For the purposes of this evaluation, only those statements on which there was complete agreement or agreement on two of three, three of four, or four of five categories, were labeled "agreement," and any instances which did not meet these criteria were labeled "no agreement."

In a test of reliability of the primary categories for the classification system, Hutchison (1963) compared the performance of two judges over 1,037 statements and obtained over 90 percent agreement. These results give some assurance that the classification system, if used as described, can provide reasonable consistency from one set of judges to another.

Measuring Instruments

The choice of measuring instruments in a research study is as crucial as any other single decision. Since investigation of classroom performance of students has been relatively infrequent, there were few guidelines. The few available studies suggested that the important factors influencing class performance were in the areas of attitude, personality development, and cognitive style; i. e., areas that have not been noted for highly reliable or valid measuring instruments. Nevertheless, for an exploratory experiment, it was decided to sacrifice some degree of precision and reliability in order to approach as closely as possible those variables that seemed pertinent. Thus, in addition to IQ and achievement measures, various instruments were used in an attempt to examine cognitive style, attitudes, and values.

While it is well known that the IQ score is highly predictive of the performance of the individual in an academic setting, it is not the only useful predictor. When a sample has a relatively narrow range of IQ scores, as in the gifted groups in the present study, other factors assume more importance in the prediction of individual differences in classroom performance. Thus, it was necessary to look for tests which do not correlate highly with IQ but might be related to classroom performance.

The Uses and Consequences tests used in the present study were adaptations of those proposed by Guilford (1956). In factor analyses, Guilford found performance on certain tests to load highly on divergent thinking, a factor which he considered closely related to creative abilities. Both the Uses and Consequences tests have been used in other factor analytic studies, in which they also seemed to load significantly on this divergent thinking factor (Kaya, 1960; McGuire, Hindman, King, & Jennings, 1961). In addition, other studies (Getzels & Jackson, 1962; Torrance, 1962) have indicated that performance on these tests does relate to academic achievement.

The Uses Test. As originally devised, the Uses test was composed of six questions; the student was given ten minutes for each question (Kettner, Guilford, & Christensen, 1959). In the present project, the time limit was reduced to four minutes and the test to three questions in order to fit the time allotted in the total battery. Two sets of questions were devised following the basic form of the Uses test. Having been assured that there were no right answers, the subject was asked to list as many uses for a given object or activity as he could within the four minute period.

Since it has been shown that changes in time and instructions have an influence on test results (Christensen, Guilford, & Wilson, 1957; Gold, 1963), the precise instructions for the test are given below:

> We often become so used to using certain articles in specific ways that we forget that they can be used for many other purposes also. For example, a shoe could be used to drive a nail or a magnifying glass can be used to start a fire. On the following pages you will have a chance to think up some of the different ways that certain familiar articles could be used.

In the present project, three major scores were obtained from the Uses test:

1. Fluency, or the total number of responses given to three questions.
2. Breadth, or the total number of general categories used. (I. e., one use for brick would be "building a garage" in the general classification, construction. Another use, "to hit someone," would classify it as a weapon. The total number of such classifications would represent the breadth score.)
3. Flexibility, a measure of the number of shifts from one classification to another when the subject's responses are read in the order listed.

The scoring system for the Uses test in the present study was developed on a trial and error basis and categories were refined through staff discussion and successive tryouts. Two trained judges rated 100 cases; the interjudge reliability score was .99. Thus, there was reason to assume that the scoring system could be used by trained judges.

Table 6 shows the stability over time of ideational fluency (as measured by the Uses test) as a personal characteristic in some of the present groups. In the first instance, one class of twenty-four students given the same test again after a time lapse of two months obtained a test retest correlation of .77. With the introduction of different forms, the test retest correlation over a period of one year with 53 subjects was .46.

TABLE 6

The Stability of Fluency as a Personal Characteristic

Group	*N*	*Uses Test—Fluency* *Time Lapse*	*r*	*Forms*
ABLE	24	2 months	.77	A&A
JACK-KING	53	1 year	.46	A&B

Reliability and stability coefficients were generally comparable to those obtained in other studies. While they did not reach the reliability level of instruments such as achievement tests, the characteristics measured could be expected to fluctuate from one time to another in the same individual, since they depend upon attitude and cognitive style.

The Uses questions in set A were:

1. List on the paper all of the uses you can think of for a brick.
2. List all of the things you can think of that might bring comfort if you were hot.
3. List how many ways water can be made to work for you.

The questions for set B were:

1. List all of the uses you can think of for a newspaper.
2. List all of the things that might bring you comfort if you were cold.
3. List all the uses you can think of for a screwdriver.

The Consequences Test. The Consequences test has received prominent use in test batteries investigating productive thinking or creative abilities. In this case, three questions were used, the subject having four minutes to respond to each. The subjects were given the following instructions:

> Inventions such as the automobile and television often change our lives in many ways aside from their original use. For example, the automobile has changed the dating habits of our youth and television has become used as a type of baby sitter for our children. It is fun to try and think about what effects might be produced by other future changes.

The first form of the Consequences test used the following questions:

1. What would happen if pills were developed which would substitute for food?

2. What would happen if everyone were born with three fingers and no thumbs?
3. What would happen if the average temperature for this area rose 15° all year round?

The second form of the Consequences test included the following questions:

1. What would happen if everyone in the world suddenly lost their hearing?
2. What would happen to Illinois if it rained six months out of the year?
3. What would happen if everyone lived to be about 200 years old?

The scoring standards for the Consequences test were a matter of considerable concern to the project staff. Attempts were made to devise a quality score, but each was abandoned because of low interjudge reliability. Finally, on the basis of interjudge correlation of .90 and above, four scores were derived.

1. Fluency. The total number of responses given.
2. Breadth. The total number of general categories used. (These categories, similar to the Uses test, were developed through successive trials and discussion of protocols that generally were not being used in the research analysis.)
3. Problem-solution. A ratio score was obtained between number of answers and number of actual solutions. The types of answers produced revealed that the children had different styles of responding to the Consequences test. Some children concentrated on the number of problems that would result from a given condition, whereas other children concentrated on ways of solving these problems.
4. Personal-nonpersonal score. The subject was scored on whether or not he was inserting himself into the answers; e. g., "I would go hungry," as opposed to, "People all over the world would go hungry."

Recent work by Guilford, Merrifield, and Cox (1961) confirms that the Uses and Consequences tests are closely related to two components of divergent thinking, ideational fluency and spontaneous flexibility. Breadth scores seem to possess high factor loadings on spontaneous flexibility, while total response scores weigh heavily on the general factor of ideational fluency. Kaya (1960), in her investigations of measures of creativity, indicated that both the Uses and Consequences tests loaded highly on a flexibility factor.

Semantic Differential. Since the book, *The Measurement of Meaning,* by Osgood, Suci, and Tannenbaum (1957) was published there has been continued interest in the research potential of the semantic differential technique. In this technique, the subject is given a series of concepts to which he must respond on a continuum of adjective pairs: good-bad, heavy-light, or beautiful-ugly, etc.

Osgood (1962), in his recent summary of cross cultural research on the semantic differential, found that when factor analyses were calculated on the results, similar factors were found across cultures. He also commented that there is no such thing as *the* semantic differential, that each use depends upon the particular concepts and set of adjective pairs used. This study used the same scale as a previous research project by Pierce and Bowman (1960). A comparison of high achieving and low achieving gifted secondary school students showed significant differentiation between both high and low achievers, and girls and boys. Analysis of the use of this scale is given in the Analysis section.

Sentence Completion Test. Choosing an appropriate personality measure for preadolescent children is difficult, and the recent accumulation of negative evidence regarding the validity of projective techniques has tempered enthusiasm. On the other hand, the risk involved in using an objective scale is that the test constructor forces the subject to insert himself into the formal structure provided by the examiner, which may result in an inaccurate portrait of the subject's own world. The senior author of this report had used sentence completion tests in clinical situations with children and was impressed with the usefulness of combining objective and projective measures. The sentence completion method can:

1. Be administered to large groups of children in a reasonably short period of time.
2. Sample large areas of the child's self concept and attitudes about the world.
3. Allow the child to express himself freely without restricting him to a formal structure.

The sentence completion technique was originally developed by Payne (1928) and Tendler (1930) as an adaptation of the word association method. The scale used in this study was adapted from the Rhode-Hildreth Sentence Completion Test (Rhode, 1957). By choosing appropriate sentence stems, an attempt was made to direct the child into specific areas such as self abilities, environment, or abstract concepts such as achievement, competition, and creativity. For example, the stem "my mother" or "my father" forces the respondent to comment in some way on family members. In addition to specific content stems, a number of stems were included because of their open endedness, such as, "I wish that . . . ," "Most of the time I . . . ."

The scoring system concentrated on whether the affect revealed in the responses was generally negative, positive, or neutral. For example, the response, "My mother is often cross and irritable," would be scored as negative affect; "My mother is a wonderful person," would be positive affect; and "My mother is 5 feet 4 inches tall," would be neutral. The scoring system was based on a seven point scale ranging from ++ in high positive affect to –– in high negative affect. The judge read the entire protocol, identified the number of the item which referred to the particular characteristic, and then rated that characteristic. The individual's raw scores for the various items were used in the component analysis and multiple regression analysis.

To investigate interjudge reliability, 20 protocols chosen at random from the experimental group were independently scored by two judges familiar with the scoring manual. As Table 7 indicates, this sample yielded a total of 460 categories for which some affect valence was assigned. Judges agreed on valence direction 93 percent of the time. They agreed on identical valence 73 percent of the time and disagreed by one valence step only 24 percent of the time. The judges disagreed by two or more valence steps on 15 of the 460 statements, or 3 percent of the time. These results were taken as establishing good scoring reliability for the test itself.

In studies on the general validity and reliability of sentence completion measures completed by Rotter (1951) and by Rhode (1957), validity coefficients ranging from .61 to .82 were obtained (generally by using the scores of expert raters correlated with sentence completion scores). Hiler (1958, 1959), by using the sentence completion test as compared with an objectively scored attitude scale, found significant relationships

TABLE 7

Interscorer Valence Agreement for Sentence Completion Test

Type of Agreement for 23 Categories[a]	*N*	*Percentage*	*Percentage Range*
Two Judges Agreed on Valence Direction	426	92.6	75-100
Two Judges Agreed on Identical Valence	335	72.8	50-90
Two Judges Disagreed by One Valence Step	110	23.9	20-50
Two Judges Disagreed by Two or More Valence Steps	15	3.2	0-10

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[a] From R. Smith, 1962, p. 35.

and was also able to distinguish between early terminators and long term psychotherapy clients. Similar favorable findings were reported on test retest reliability, stability, and interscorer reliability.

Teacher Ratings. Teacher ratings (Table 8), obtained on all students involved in the project, were concentrated on certain dimensions related to the underlying theoretical structure of the project. The dimensions presumed most related to divergent thinking abilities were foresight (the ability to see implications) and unique ideas. The dimension described in the rating scale as analysis would seem to be more related to convergent abilities. Self motivation, self esteem, and sociability were chosen as potentially relevant personality and attitudinal characteristics which could be readily observed by the teacher.

Previous experience with teacher rating scales (Gallagher, 1960) suggested that, in order to obtain meaningful teacher ratings, the dimensions must be reasonably specific and descriptive; it is advisable to avoid a middle point on the scale; it is advisable to force judgment into one of the categories, rather than allow gradations of judgment; and the number of steps in the rating scale should be relatively small since a large number appears to have a spurious distinctiveness.

A comparison of the stability of the two major areas of the scale, cognitive and social characteristics, revealed substantial consistency in ratings. Twenty-three children were rated by two different teachers within a time interval of approximately one year, and correlation between the ratings of the teachers was computed as .72 for the cognitive abilities and .50 for sociability.

Analysis of Data

The data analysis was divided into three major sections:

1. A statistical description of the classroom performance of the various teachers and classes involved in the study.
2. A correlational analysis relating student classroom performance measures to outside variables: academic, personality, and attitudinal.
3. Comparative analyses among the various subgroups of the total student population, divided by sex, age, cognitive style, IQ scores, etc.

Statistical Description. In order to present the actual classroom performance of students and teachers as categorized by the classification system used in the study, a tally, by category, was made of the performances of each student and teacher in the five consecutive class sessions. Proportions of the primary thought categories were calculated for

TABLE 8
Teacher Rating Scale on Personality and Attitudinal Characteristics of Students

Dimensions	*Level One*	*Level Two*	*Level Three*	*Level Four*
I. Self Motivation	Rarely needs encouragement. A self starter. Often thinks up extra projects on his own.	Usually self motivated. Has periods of reluctance or indifference. Bounces back quickly from these.	Can be roused occasionally through much encouragement, or by a project or personal interest. Otherwise tends to be apathetic.	Seems generally apathetic and uninterested. Does not grow excited or intrigued with classroom. Seems passive.
II. Foresight	Generally shows an ability to see implications and a readiness to look for them. Almost always sees what is coming next. Insights often seem to be mental leaps forward.	Usually sees further implications more often than the ordinary student. Sometimes slumps into unimaginative performance.	Shows occasional flash of foresight. This is generally a surprise to the teacher. More often uninspired.	Very pedestrian. Does not think of implications or consequences related to issue being discussed.
III. Self Esteem	Supremely self confident. Rarely, if ever, seems bothered or held back by self doubt.	Sometimes shows self doubt under stress. Usually unexpected, since he is generally considered a stable individual.	Seems often to express negative view of self. Occasionally brightens up under praise or favorable circumstances.	Shows consistently negative attitude towards self. May reveal this by giving impression of great conceit or self admiration.
IV. Unique Ideas	Can be counted on to come up with a unique answer of good quality to many issues raised in class. Hard to stop from producing.	Usually comes up with some fresh ideas, but sometimes disappoints with commonplace ideas.	Shows occasional flashes of fresh ideas, but not consistently. Routine performance, generally.	Seldom or never produces a novel idea. Usually gives back what can be obtained from class, teacher, or text.
V. Analysis	Excels in tasks demanding analysis; efficiently draws together evidence leading to solutions. An ideal detective.	Good on analysis in certain tasks, routine in others. Uneven performance, but leans in productive direction.	Is sometimes stirred to analyze. Usually spotty in performance. Does not persist long.	Seems repelled by questions or situations involving analysis. Avoids them whenever possible.
VI. Sociability	Socially popular. Very active with peer group. Almost always seen in company of others.	Gets along well with others. Can work individually, but seems to prefer group activities (work, social) if given choice.	Often alone, pursuing own interests. Interacts with others when necessary. Seems to prefer being alone much of the time.	A loner. Spends little time with others. Comes and goes by himself; seemingly prefers it that way.

teacher questions, teacher answers, boys' statements, and girls' statements for each class group. These proportions were used to make comparisons between different class sessions and different groups.

In order to provide a rough comparability of individual classroom performance across class groups, the total of each major thought category for each individual was divided by the total class performance in that category. For example, if Sam had 10 statements in the divergent thinking category and the total generated by his class group was 100 statements in that period, Sam would receive an index of 10/100 or 010. This adjusted classroom score would be comparable to that of a student in another class who made 20 divergent statements out of a total of 200. These adjusted classroom indices were used as the basic classroom performance data in later component analyses. Chi squares were computed to indicate differences from expected or norm performance.

Correlational. To obtain information on interrelationships between classroom performance and numerous academic, intellectual, and personality variables, the adjusted classroom indices, cognitive abilities test data, personality and attitude dimensions, and teachers' ratings were placed in a component analysis using the varimax criterion for analytic rotation (Kaiser, 1958, 1962).

The semantic differential concept scores were obtained by summing the scores over the fourteen adjective pairs. The teacher ratings were reduced from six to two based on an initial factor analysis which indicated that five of these six rating scales clustered into a general cognition factor.

An analysis of variance was included to identify those variables that appeared to have the most influence on student classroom performance. In other correlational analyses, traditional parametric and nonparametric measures were used as appropriate.

Comparative Analysis. In order to make a comparative analysis of classroom performance among recognizable subgroups of the total population, the performance data were analyzed and reviewed by sex, age, and cognitive style. The fundamental tool for this analysis was the *t* test, or chi square where a nonparametric test seemed appropriate.

4

Results

Results were organized to present data related to the specific project objectives and to questions that emerged as the project progressed. The major questions asked were:

1. What were the proportions of the various thought processes expressed by teacher and by students?
2. What were the relationships between classroom performance and outside variables?
3. What was the relationship between the cognitive performance of teacher and students?
4. Was the classroom cognitive style of gifted children consistent over changes of time, subject matter, and teacher?
5. Was cognitive expression of teacher and student consistent within a given class section?
6. What relative influence did the group, class section (time of day?), and day of week have on variance of verbalized productive thought in the classroom?
7. Was sex a relevant variable on classroom expressiveness and other variables?
8. Were there differences between cognitive style subgroups?
9. Were there differences between expressive and nonexpressive students?

Proportion of Various Thought Processes Expressed by Teacher and by Students

Graphs were constructed by taking the total responses for a class session and dividing them into the four primary categories: cognitive memory, divergent thinking, convergent thinking, or evaluative thinking. Responses in the category termed routine were considered irrelevant and not used in constructing these graphs. Distinction was made between teacher questions and teacher statements. The questions teachers ask were considered indicative of the type of thought processes asked for on the part of the students. On the other hand, teacher statements appeared to represent a type of personal teaching style.

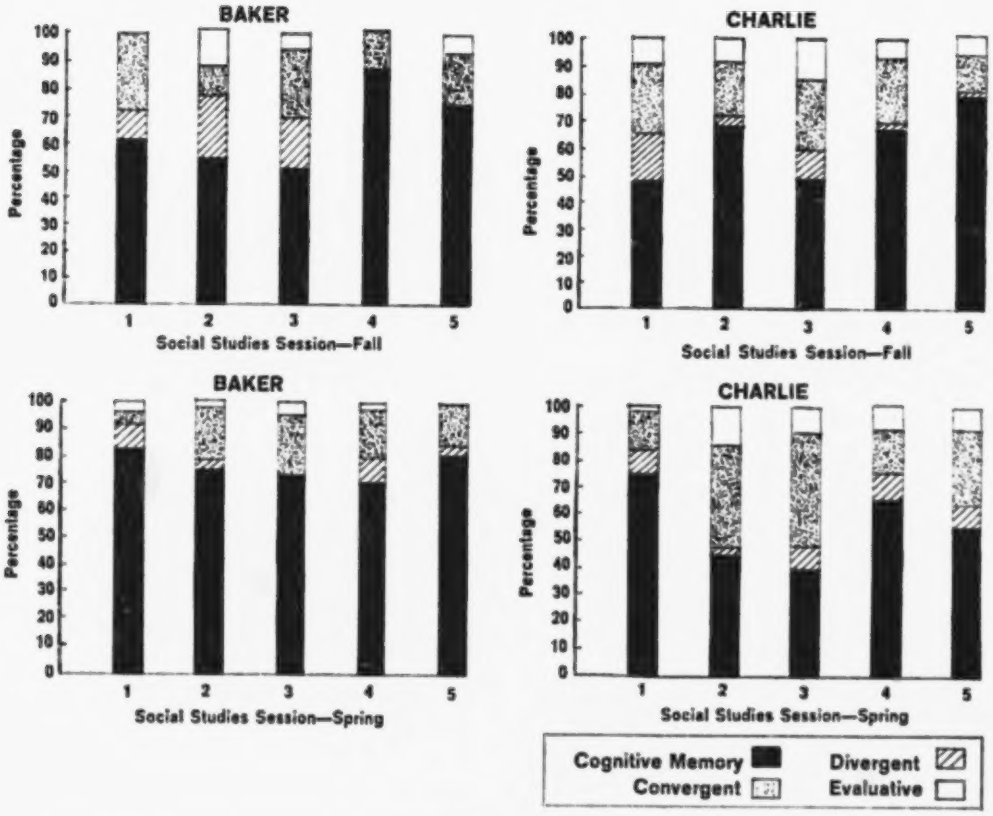

Figure 3. Proportion of Thought Processes Asked for by the Teacher

In reporting student behavior, all of the statements were counted whether they were questions or answers. It was noted in the recordings and observations of the classroom that students often seemed to be asking questions when, in fact, they were giving answers. For instance, if the teacher asked, "Who was one of the foremost leaders of settlers in the Carolinas?" a student might respond, "Wasn't one of them Sir Walter Raleigh?" Early in the project, Dr. Aschner classified these tentatively given student responses as *quanswers.* Since much of the question asking behavior of the students was of this nature, student questions and statements were combined into one graph.

Figures 3 and 4 show the proportions of the four thought processes in five consecutive sessions of the BAKER-CHARLIE social studies class, recorded first in the fall of the year and again the following spring.

Figure 3 shows teacher variation from one class session to another and from one group to another. For example, in BAKER-Spring, the teacher asked for cognitive memory responses more than 70 percent

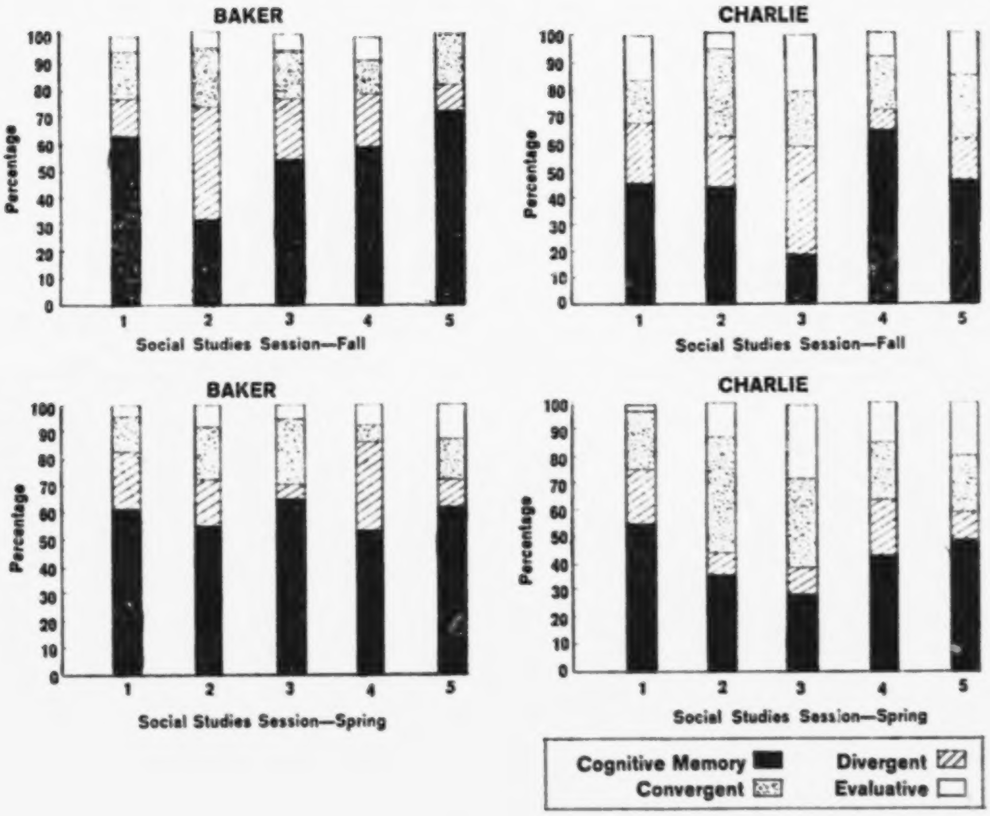

Figure 4. Proportion of Thought Processes Given by Boys

of the time in each session, whereas in CHARLIE-Spring, the range of such questions was from 40 percent to over 70 percent. Despite the fact that this teacher was considered skilled in stimulating good thinking, approximately 50 percent of the teacher questions were of the cognitive memory type. This seems an almost inescapable average for a teacher who deals in detailed factual information. Even when problem solving or evaluative conclusions are the goals, it is necessary for the students to have a broad base of information. It is likely that practically all teachers at this grade level produce a baseline of approximately 50 percent memory questions.

In some class sessions certain kinds of thought processes were not requested at all by the teacher. For example, in BAKER-Fall 4, there were no requests for evaluative thinking or divergent thinking. In BAKER-Spring 3, there were no requests for divergent thinking, and in BAKER-Spring 5, no requests for evaluative thinking. This again underlines the importance of obtaining a large sample of observations on a given teacher, lest the conclusion be made that this teacher never calls for some kinds of intellectual responses. Results suggest that, on given days, a teacher does not ask for certain kinds of intellectual behavior.

Another pattern was noted in the BAKER-Fall series. Divergent thinking occupied an appreciable proportion of class time in the first three sessions but did not appear at all in sessions 4 and 5. In the BAKER-CHARLIE Spring sessions, however, divergent thinking seemed to be spread rather thinly and equally over the five sessions. Thus, a particular teacher's performance is related to the general flow and purpose of classroom operation at a given time.

A comparison of student performance (Figure 4) with teacher requests in these same classes (Figure 3) indicates the dependence of the expressed student thought processes upon the type of teacher questions asked. Thus, in the CHARLIE-Fall sessions 1, 2, and 3, extensive teacher requests for evaluative and divergent thinking produced the highest percentage of productive responses on the part of the boys. Although all data were calculated separately for boys and girls, both had essentially the same proportion of responses and reporting both would be repetitious.

In the area of divergent thinking, it was obvious that a small percentage of teacher requests can bring forth a much larger percentage of response from the students. Open ended questions stimulated a great many student statements. For example, the teacher question, "What would have happened if the Spanish Armada had been victorious over the English?" brought forth a veritable snowstorm of student responses along many dimensions. The figures also indicated differences between groups. CHARLIE and BAKER groups, one of which met in the morning and one in the afternoon, appeared to differ in proportions of thought processes despite the fact that the subject matter was nearly identical.

Figure 5 presents the five consecutive class sessions of two teachers in two different content areas of science. The DAN and EASY sections were grade 9 classes in biology, and the FOX and GEORGE series were grade 10 classes in physics. Proportions of thought processes requested by the teachers confirmed general expectations. Teachers in these science courses tended to concentrate on cognitive memory and convergent thinking rather than divergent and evaluative thinking. There was less teacher variation from one class to another than in the case of the social studies teacher. There were, a priori, some expectations that science courses would present different proportions of the thought processes than English or social studies, and these expectations were generally realized.

As previously noted, there were instances in various class sessions in

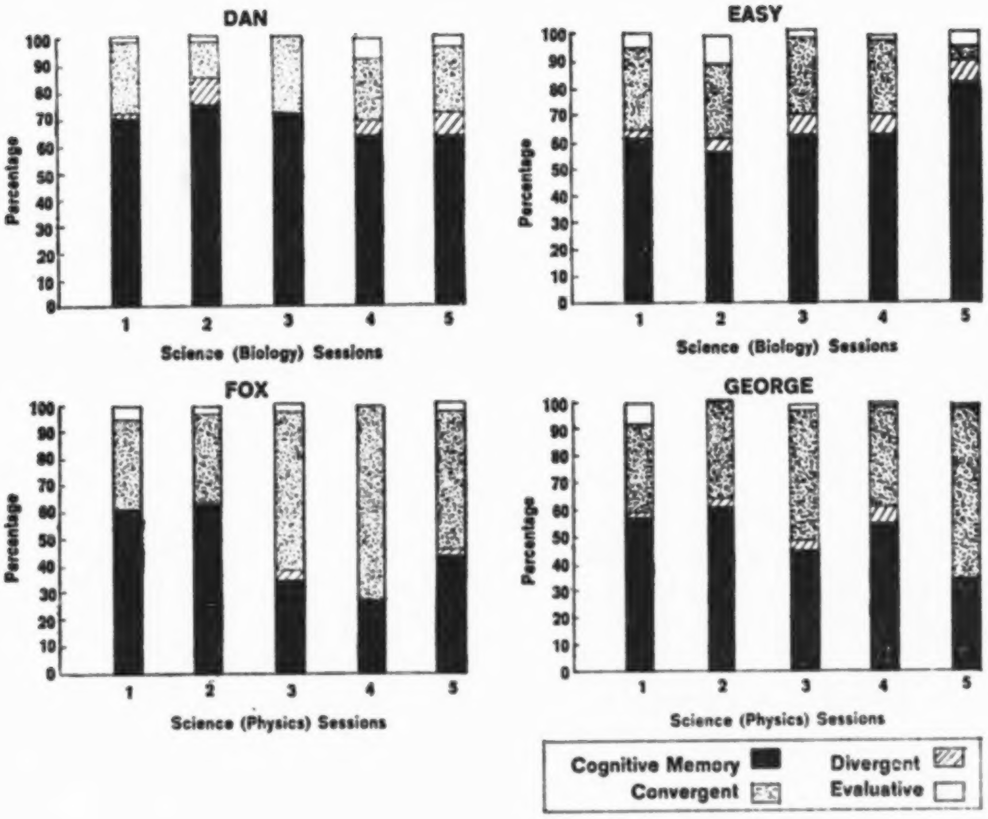

Figure 5. Proportion of Thought Processes Asked for by the Teacher

which certain kinds of thought operations were completely shut out. No questions related to evaluative or divergent thinking in FOX 4, and the same situation prevailed in GEORGE 2 and DAN 3. There were no requests for divergent thinking in GEORGE 5, and so it went.

In the FOX and GEORGE series, divergent and evaluative thinking made up less than 10 percent of the total teacher questions in any one class session. The percentage of requests for these two thought processes was somewhat higher in DAN-EASY, but at no point did the combined percentage for the two areas go above 20 percent. On the other hand, convergent thinking often reached 50 percent or more.

In Figure 6, student performance in these courses can be observed to follow rather closely the requests for certain thought processes by the teacher shown in Figure 5. A relatively small number of divergent thinking questions brought forth a substantial proportion of student responses in this area. The consistently high level of convergent thinking in these classes (as compared to social studies) seemed to reflect the demands of the teacher. Since teachers in the science sections varied less in performance from day to day, student performance also seemed to vary less. In comparing the styles of the two teachers, the DAN-EASY instructor asked more cognitive memory questions, while the teacher in the FOX-GEORGE group asked for more convergent thinking responses.

Figures 7 and 8 present the classroom performance of the final four groups in the study. One teacher taught both the HAT and IDEA sections of social studies; another teacher taught both the JACK and KING sections of English. The differences in teaching style are reflected in the different proportions of thought processes. The social studies teacher asked for a greater degree of evaluation than did either the English teacher or, apparently, the social studies teacher shown in Figure 3. These graphs also suggest that the type of questions asked by the teacher depends partly on the structure of the group. There were clear differences between types of questions asked in the HAT and IDEA sections despite the fact that the same material was covered on the same days by the teacher. With both teachers, considerable varia-

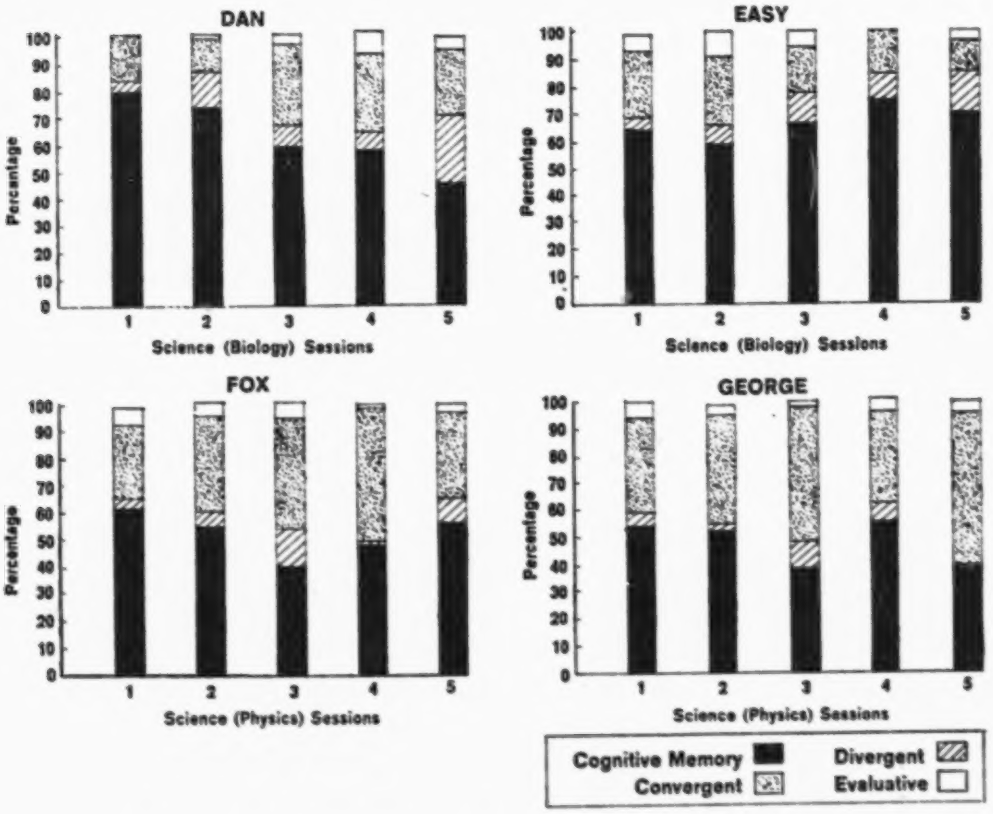

Figure 6. Proportion of Thought Processes Given by Boys

tion was noted from one session to another in the same class. No one class session could be considered typical.

In the JACK and KING English sections, the teacher's questions were predominantly cognitive memory and convergent thinking. Only in KING 2 did either evaluative or divergent thinking occur in more than 15 percent of the inquiries. Requests for divergent thinking were infrequent; such questions did not seem to be a part of this teacher's style.

As might be expected, student performance (Figure 8) followed rather closely the pattern requested by the teacher. Since very little divergent thinking was encouraged by the English teacher, little student divergent thinking occurred in JACK and KING sections. However, a high proportion of convergent thinking was noted. In response to more requests for evaluative judgment in both the HAT and IDEA groups, the students produced a substantial proportion of evaluative responses. This is in contrast to the science groups (Figures 5 and 6).

In summary, much of any teacher's questioning is in the cognitive

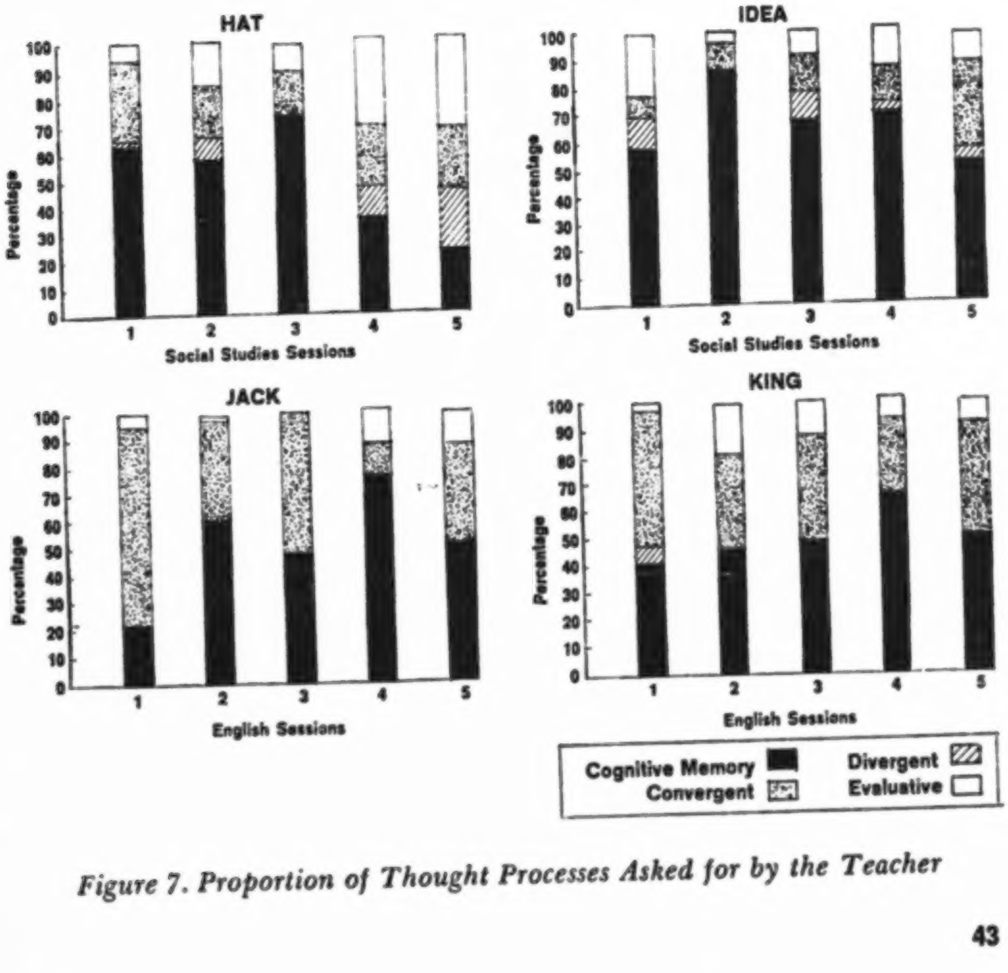

Figure 7. Proportion of Thought Processes Asked for by the Teacher

memory area, and convergent thinking seems likely to be the next largest proportion. Whether or not divergent thinking appears in student performance depends on the teacher's own philosophy and style of teaching. A very respectable classroom (in terms of cognitive performance) can be operated without divergent thinking being requested at all. The same could not be said about cognitive memory or convergent thinking.

These figures suggest that different subject matter areas seem to pull different proportions of thought processes, although teachers still show individual styles within a given subject.

While the preceding figures give an overall picture of the distribution of responses in the major categories, an impressive range of individual differences between teachers, within teachers, and between classes is shown in a breakdown of the secondary categories.

Table 9 indicates secondary category questions asked by teachers in the five day series for each of the 12 class groups. In the area of cognitive memory, requests for recapitulation or pure memory items ranged

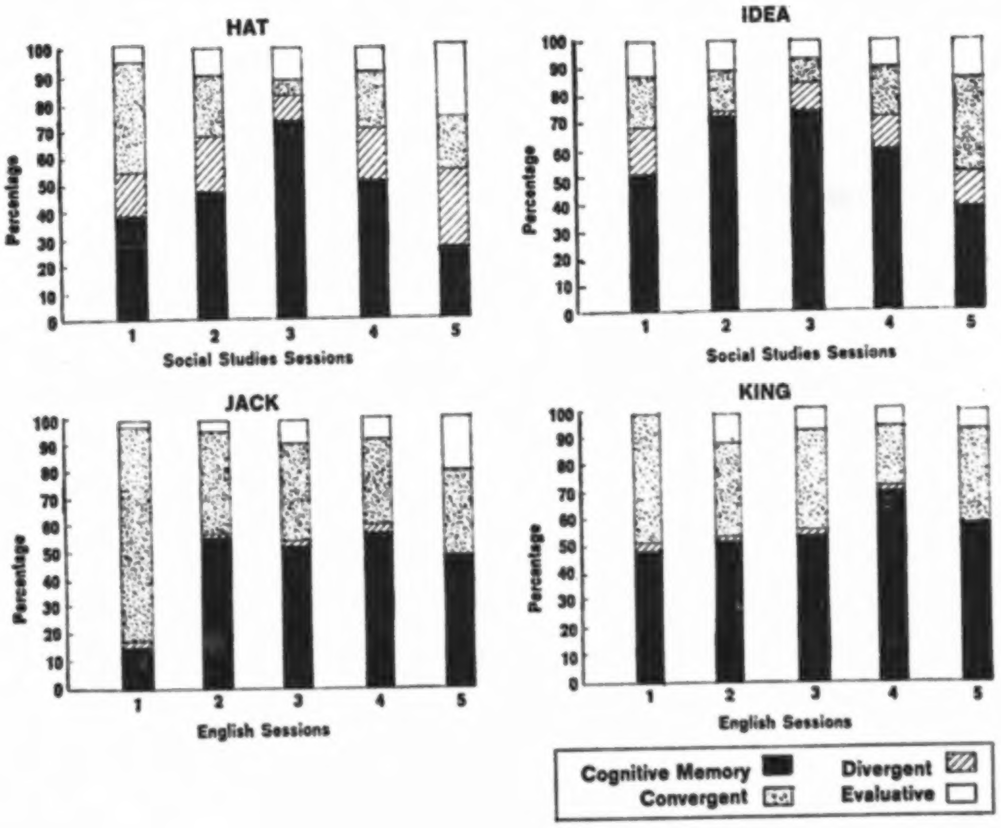

Figure 8. Proportion of Thought Processes Given by Boys

from 30 teacher questions in HAT to 90 in the FOX section. Facts requested vary from 31 in BAKER-Fall to 153 in DAN.

Since it is tempting to ascribe such differences in performance to differences in subject areas, it is important to compare teachers of the same general subjects. Many more convergent thinking questions were requested in FOX-GEORGE than in DAN-EASY, yet all were science sections. Many more factual questions were asked in DAN-EASY than in FOX-GEORGE. These results were apparently influenced more by differences in teacher style than by the pressures of the subject matter. Similarly, the teacher in the social studies sections of HAT-IDEA asked for considerably fewer facts and less convergent thinking than did the teacher in the social studies sections of BAKER-CHARLIE, although both covered the same subject matter and almost the same topics.

In convergent thinking, the range in numbers of teacher questions seeking conclusion statements extended from a low of 1 in CHARLIE-Fall to a high of 43 in GEORGE. In this respect, it is of interest to compare the number of conclusion statements made by the teacher with the number asked of the students. In most class sections, teacher conclusion statements outweighed teacher conclusion questions by a ratio ranging from 3 to 1 to 10 to 1. Only one teacher requested more conclusions from the students than he gave himself.

The goal of this project was not to arrive at some theoretical ideal of teaching style, but rather to describe what actually happens. If, for example, the teacher had a commitment to the discovery method, in which teachers encourage the students to reach conclusions on their own, then a ratio of 5 to 1 or 6 to 1 of teacher conclusion statements to teacher conclusion questions would be viewed with some alarm. If, on the other hand, the goal were to present concisely and clearly the most important point in the discussion, such a ratio might not be looked on with disfavor.

In the social studies sections, the translation (Tr) column under convergent thinking involved map reading; in the science sections, it involved moving from the symbolic language of mathematics to the semantic area. Requests for explanation or logical reasoning to justify positions or conclusions varied from 10 in IDEA to 92 in FOX.

As previously noted, teacher questions on divergent thinking and evaluative thinking were fewer in comparison to cognitive memory and convergent thinking. In the elaboration subcategory surprisingly few teacher questions were asked. Divergent implications, stressing extrapolation or projection of an idea from given data, received only slightly more attention. The range was from 0 requests in KING to 11 in CHARLIE-Fall. As was true with other divergent questions, one teacher question can bring forth a volume of responses from the students.

TABLE 9

Secondary Category Classifications of Teacher Questions and Statements

Teacher Questions

Groups	*Routine*					*Cognitive Memory*					*Convergent Thinking*					*Divergent Thinking*					*Evaluative Thinking*				
	St	Ver −	Ver +	Du & Mu	Hu	Scr	Re	Clm	Clq	F	Tr	As	Ex	Con	Total	El	Ad	Imp	Syn	Total	U	S	Q	Total	All Total
BAKER-FALL	1	0	0	0	0	0	77	27	7	31	0	22	29	2	53	2	4	8	0	14	4	16	2	22	232
BAKER-SPRING	2	0	0	0	0	0	49	30	5	48	11	21	23	3	58	2	4	9	0	15	4	14	0	18	225
CHARLIE-FALL	1	0	1	1	0	0	40	31	4	14	0	18	23	1	42	0	9	11	0	20	3	7	0	10	224
CHARLIE-SPRING	0	0	0	0	0	4	72	48	6	79	4	14	25	2	45	2	7	5	0	14	0	7	0	7	275
DAN	1	0	0	0	0	0	64	17	10	153	8	29	31	7	75	0	14	6	0	20	3	6	0	9	349
EASY	3	0	0	0	0	1	46	7	0	141	4	28	32	7	71	0	13	4	0	17	5	11	0	16	302
FOX	2	0	0	0	0	0	90	30	6	50	10	52	92	41	195	0	3	2	0	5	0	11	0	11	389
GEORGE	2	0	0	0	0	2	58	34	3	78	18	17	84	43	162	0	4	6	0	10	2	7	0	9	358
HAT	3	0	0	0	0	6	30	25	5	41	1	18	14	9	42	1	8	4	0	13	8	21	0	29	194
IDEA	3	0	0	0	0	2	30	41	13	36	2	14	10	4	30	3	5	3	0	11	13	9	0	22	188
JACK	3	0	0	0	0	1	59	16	3	43	0	37	14	28	79	0	0	1	0	1	6	13	0	19	224
KING	1	0	0	0	0	0	48	16	4	51	0	41	18	25	84	0	2	0	0	2	9	16	0	25	231

TABLE 9—continued

Teacher Statements

Groups	*Routine*					*Cognitive Memory*					*Convergent Thinking*					*Divergent Thinking*					*Evaluative Thinking*				All
	St	Ver —	Ver +	Du & Mu	Hu	Scr	Re	Clm	Clq	F	Tr	As	Ex	Con	Total	El	Ad	Imp	Syn	Total	U	S	Q	Total	Total
BAKER-FALL	126	23	41	7	6	5	107	98	33	27	6	20	25	49	100	16	9	6	0	31	58	12	7	77	681
BAKER-SPRING	183	36	55	10	13	8	176	132	55	78	19	30	33	61	143	13	12	4	0	29	71	17	5	93	992
CHARLIE-FALL	154	63	59	11	12	4	119	112	65	54	2	28	34	51	115	8	14	11	0	33	55	12	3	70	871
CHARLIE-SPRING	224	24	63	23	18	11	174	120	76	50	15	24	36	63	138	6	26	9	0	41	69	25	10	104	1,066
DAN	177	11	22	11	1	17	280	76	78	121	12	34	83	59	188	4	12	3	0	19	123	19	2	144	1,145
EASY	167	6	6	18	4	14	263	113	55	168	18	60	93	60	231	8	20	7	0	35	98	30	2	130	1,210
FOX	184	35	0	15	25	6	290	68	39	57	24	13	32	14	83	4	8	3	0	15	28	10	2	40	857
GEORGE	268	27	3	12	38	2	208	45	22	83	36	12	19	17	84	1	8	1	0	10	26	7	0	33	835
HAT	139	12	14	3	3	4	88	59	10	16	8	15	9	35	67	2	9	4	1	16	24	6	0	30	461
IDEA	188	18	36	1	9	1	65	45	9	9	3	18	7	33	61	4	11	5	0	20	48	3	0	51	513
JACK	236	10	14	1	20	1	136	120	65	53	0	37	55	66	161	6	9	0	0	15	109	10	3	122	954
KING	276	24	12	5	18	1	232	161	79	48	1	61	64	77	203	10	7	4	0	21	96	20	2	118	1,198

In Table 9, the teacher statements are categorized reflecting intellectual and management expressions not generally designed to elicit student comments. While types of questions asked indicate the goals of the lesson, statements seem to reveal more of the teacher's personal style.

Under Routine category in Table 9, a wide range of differences among teachers in the expression of negative and positive verdicts can be noted. Verdicts represented teacher approval or disapproval of student behavior or performance. The ratio of positive to negative verdicts was of interest, as well as the absolute number of verdict statements. The most favorable ratio was found in CHARLIE-Spring where the teacher gave 63 positive verdicts as opposed to 24 negative verdicts over the five sessions. At the other extreme was the FOX section in which the teacher gave no positive verdicts and expressed 35 negative ones. Group differences influenced the verdict ratio, as can be seen in differences between sections which had the same teacher. For example, in DAN the positive to negative verdict ratio was about 2 to 1, whereas in EASY, the afternoon section with the same teacher, the ratio was 1 to 1 with fewer verdicts of either kind. The ratio was fairly even in HAT, but in IDEA there was a 2 to 1 positive to negative margin. Similar differences between sections with the same teacher were found in the JACK-KING group.

It is of interest to compare the positive to negative verdict ratio in the boys' statements. (The girls, as seen in Table 10, do not often give verdicts of either sort.) The ratio of the boys' verdicts seemed highly related to the ratio of the teacher verdicts; a Spearman rho correlation of .82 was found in the verdict ratios of teachers to verdict ratios of boys. No simple causal relationship need be inferred. It is likely that some complex affective balance was established between teacher and students in each classroom.

In the category Humor, the range extended from one such teacher statement in DAN to 38 in the GEORGE section. As with other figures, these numbers obscure complex behavior. Humor can be either directly related to the classroom material, or it can be off beat, such as a humorous story which appears to derail the classroom discussion rather than further it. As an example of another type of humor, the casual introductory statement by the teacher, "Now that we no longer have daylight saving time, it was easy to get up this morning," would be classified as humor, as would be the student response, "It was?" Such humor seemed to create a more relaxed atmosphere without interfering in the academic operation of the classroom. Another type of humor, suggesting that all was not as it should be in the teacher student relationship, was noted, for example, in the statement:

T: I will now hook up the apparatus and we'll see what happens.
John: If you're in your usual form, nothing will happen.

Interchange of this nature, particularly if the sentiments are supported by other students in the class, carry a bite quite different from the casual quip or play on words that occurs in most classes of gifted children.

In dispensing of facts, as shown in Table 9, the range of teacher statements extended from a low of 9 factual statements in the IDEA section to a high of 168 in the EASY section. This marked difference seemed to reflect that information dispensing characterized the DAN-EASY sections, in contrast to the HAT-IDEA classes where less time was spent on specific facts and more with the abstract concept of colonization.

Variation in convergent thinking among teachers extended over each of the subcategories. Translation activities appeared more frequently in the science classes than in English and social studies. Explanation occurred most often in science and least often in social studies.

In sections taught by the same teacher there was more consistency in teacher statements than in teacher questions, supporting the notion that personal teaching styles are involved.

In divergent thinking, social studies teachers did not appear strikingly different from science or English teachers. The English teacher gave a representative number of divergent thinking responses although she asked for little divergent thinking from her classes. Elaboration, or the development of examples, appeared more often in social studies and English sections, as might be expected. The drawing of implications or extension of ideas were clearly not exclusive to any subject area.

It was a surprise to see that one of the science teachers showed greater expression of evaluative thinking than either of the social studies teachers or the English teacher. This could apparently be accounted for on the basis of personal style. For example, the teacher would say, "So bacteria can be parasites right on human beings. It is not very pleasant to think about but actually this can be true." This statement represents a personal evaluation, not necessarily essential to the content. All in all, the teacher statements in the secondary categories were probably better reflections of the wide range of individual differences among teachers, or within a given teacher's performance from one time to another, than those observed in the primary categories.

Table 10 shows the total performance in the secondary categories by the boys and the girls in all sessions. Comparing total verdicts, it can be seen that in almost all sections, boys outproduced the girls. The boys gave 127 negative verdicts and 25 positive ones. In contrast, the girls gave 49 negative and 9 positive verdicts. The verdict ratio remained practically the same for either sex, i.e., 5 to 1 negative to posi-

TABLE 10

Secondary Category Classification of Student Statements

Boys' Statements

Groups	*Routine*					*Cognitive Memory*					*Convergent Thinking*					*Divergent Thinking*					*Evaluative Thinking*				
	St	Ver —	Ver +	Du & Mu	Hu	Scr	Re	Clm	Clq	F	Tr	As	Ex	Con	Total	El	Ad	Imp	Syn	Total	U	S	Q	Total	All Total
BAKER-FALL	20	4	0	19	4	3	73	15	14	46	3	16	59	10	88	4	29	58	0	91	19	26	8	53	430
BAKER-SPRING	25	2	3	11	11	0	78	28	33	57	7	34	75	11	127	11	28	21	1	61	26	30	13	69	505
CHARLIE-FALL	39	5	2	15	19	0	65	33	39	98	1	15	51	6	73	5	27	67	0	99	6	11	5	22	509
CHARLIE-SPRING	62	4	2	10	48	10	122	56	66	144	21	20	56	24	121	12	62	39	1	114	23	21	13	57	816
DAN	8	0	0	13	0	1	39	14	10	112	4	29	28	7	68	0	21	9	0	30	3	7	0	10	305
EASY	0	8	3	6	9	2	53	25	17	146	2	28	30	8	68	1	26	8	0	35	3	15	0	18	390
FOX	60	14	0	29	42	3	180	56	106	135	29	85	151	58	323	3	39	23	0	65	15	22	11	48	1,061
GEORGE	91	41	10	24	55	2	112	67	109	111	57	38	163	91	349	0	27	9	0	36	16	11	4	31	1,044
HAT	42	7	2	10	14	2	41	29	71	42	3	22	46	22	93	16	30	31	1	78	14	26	6	46	477
IDEA	57	0	1	12	5	2	40	30	47	96	2	25	33	16	76	7	18	18	2	45	21	18	3	42	453
JACK	16	5	0	3	5	0	48	28	34	27	0	57	32	29	118	1	4	0	0	5	7	16	3	26	315
KING	34	37	2	5	21	0	82	51	56	55	1	52	38	43	134	0	4	3	0	7	14	16	1	31	515

TABLE 10—continued

Girls' Statements

Groups	*Routine*					*Cognitive Memory*					*Convergent Thinking*					*Divergent Thinking*					*Evaluative Thinking*				
	St	Ver —	Ver +	Du & Mu	Hu	Scr	Re	Clm	Clq	F	Tr	As	Ex	Con	Total	El	Ad	Imp	Syn	Total	U	S	Q	Total	All Total
BAKER-FALL	10	1	0	3	3	0	48	8	4	29	1	16	27	3	48	3	13	20	1	37	16	7	5	28	219
BAKER-SPRING	2	0	0	0	0	1	1	0	0	3	5	12	21	7	45	5	11	10	1	27	12	12	1	25	184
CHARLIE-FALL	28	1	2	7	3	0	40	10	14	41	3	16	31	2	52	1	18	52	0	71	16	11	6	33	302
CHARLIE-SPRING	33	1	1	9	2	4	73	13	15	0	4	16	23	13	56	7	14	17	2	41	3	7	1	11	319
DAN	5	0	0	4	0	0	47	7	7	87	2	10	5	2	19	0	9	3	0	12	3	4	0	7	195
EASY	3	0	0	5	0	0	23	6	6	74	5	17	14	2	38	0	6	0	0	6	4	2	1	7	168
FOX	41	8	1	24	31	0	124	46	71	95	10	44	76	35	165	0	12	7	0	19	9	12	6	27	641
GEORGE	55	23	5	30	36	0	93	54	93	126	7	40	60	47	154	0	6	3	0	9	5	2	0	7	685
HAT	31	0	0	8	2	6	41	22	17	58	2	11	17	11	41	3	14	7	0	24	15	9	5	29	261
IDEA	53	1	0	12	0	6	31	23	24	60	0	12	27	14	53	8	9	7	0	24	24	15	5	44	331
JACK	8	0	0	5	0	1	39	18	15	29	0	32	19	29	80	0	0	1	0	1	3	1	3	7	203
KING	14	14	0	4	11	0	40	15	31	31	0	30	32	28	90	0	1	2	0	3	9	13	0	22	275

tive ratio, in contrast to the teachers, who generally balanced out the positive and negative statements. Evidently it was easier for students to give a negative verdict. In humorous statements, the boys gave 233 while the girls gave 96 in the same period of time despite almost equal representation in the class. Similar differences occur in each content category favoring the boys at about a 2 to 1 ratio.

Among the results for boys and girls on cognitive memory, the ratio between clarifying meaning and clarifying qualification was almost even in all classes. Yet, in teacher statements, as shown in Table 9, the ratio was at least 2 to 1, sometimes much greater, in favor of clarifying meaning. Apparently, students engaged more in correcting or adding to original statements than in reformulating or clarifying ideas. Along with the high number of negative verdict responses, this fact suggests that the students were spending considerable time in class disagreeing with, or amending, other students' and teachers' statements. Observers suggested that some gifted students take this relatively easy way out—making minor corrections or amendments as their contribution to class discussion rather than generating ideas or concepts of their own, which require preparation and cognitive thinking.

Convergent thinking responses of the boys and the girls followed expected trends. The ratio of production was 2 to 1 in favor of the boys—typical of the overall results. The different styles of the two science teachers were noted to affect the performance of the students. In the FOX-GEORGE groups there were about five times as many responses as in DAN-EASY. Teacher statements and questions in Table 9 showed the DAN-EASY teacher making more statements but phrasing fewer questions in this thought dimension. This was another indicator of how closely student response was tied to teacher behavior.

In the area of divergent thinking, the total performance of the boys seemed to outweigh that of the girls in all sections except JACK-KING, in which the teacher's disinclination to encourage cognitive behavior apparently limited the performance of both groups. Most of these same students were also members of the FOX-GEORGE groups and participated in divergent thinking operations in these sections.

The category of synthesis was not often found. It appeared that expecting such high level abstracting behavior in oral discussion may be unrealistic. Gifted students perform such intellectual feats well in written work where time, prior planning, and class discussion have laid the groundwork.

Results of implication type questions show a range of boys' responses extending all the way from 0 in JACK to 67 in CHARLIE-Fall. Girls showed a similar, if more restrained, response. Thus, relatively few requests in this area generated much reaction on the part of the students.

Responses in evaluative thinking showed a rather equal division between unstructured ratings and structured probability statements. Fewer comments were made on qualification and some zero scores were obtained in this category since one can't quarrel with an unexpressed rating or judgment; for examples in DAN-EASY sections, very few ratings were made and thus few counter judgments expressed. There seemed to be more differences among class sections in evaluative thinking than in other categories. Generally, this was brought about by one student making a judgmental response and the rest of the students chiming in with judgments of their own.

In summary, while the performance of the students seemed highly related to teacher performance over all cognitive areas, there remained impressive differences between sections with the same teacher. This suggested that perhaps there were more complex factors, involving the composition of the group and perhaps even the accident of the particular topic of discussion, influencing the proportion of statements made in each category.

In view of the obvious variations among the teachers, all of whom had been rated as effective teachers by their supervisors, empirical study of just what is meant by teacher effectiveness seems desirable as a first step. For example, with one particular style such as teaching phonics or using the discovery method, it would probably be necessary to analyze in some depth the actual performance of individual teachers, rather than to assume that classroom behavior would be similar because they had the same philosophy of teaching or the same background of training.

Relationship between Inclass and Extraclass Factors

Tables 11 and 12 show the results of the principle axis component analyses (varimax rotation) computed to determine the relationships between scores on the classroom interaction system and a variety of external variables. The sample was divided into Group A and Group B to keep chronological age from being an intrusive influence. In addition, boys' and girls' data were analyzed separately. The component analysis is very similar to the more commonly used factor analysis. The difference lies in the value inserted in the diagonal of the matrix. In the component analysis it is the sums of the squares. The reader is invited to interpret components in the same framework that one would interpret the more commonly used term, factor.

Group A Results. Table 11 shows the component loadings obtained

TABLE 11

Group A Principal Axis Component Loadings by Sex (Varimax Rotation)

	Boys							Girls						
Variables	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Classroom Performance														
Cognitive Memory		76				36		83						
Divergent		77		34				85						
Convergent		88						81				37		
Evaluative		84						88						
Test Data														
Verbal IQ			79							86				
Nonverbal IQ			77							84				
Uses Breadth				53		47		35					61	
Consequences Breadth				93				30					81	
Consequences S/T					87									87
Semantic Differential														
Mother	83								82					
Father	84								70			39		—31
Student	79							—41	52		38	31		
Work	75								66	—35		43		
Competition	31							33	72					
Success	52	—33					32		67					
Love	44		37		—60				56			43	—39	
Faith							78	—46	52		30			
Imagination	32					37	—62					85		
School	65								65	—38			—31	
Teacher Rating														
Cognition		56	42					31			—.72			
Sociability						76					—.83			30
Chronological Age		31		47		31				—70	—50			
Percent Variance	27	22	12	11	10	10	8	24	24	16	11	10	8	8

TABLE 12

Group B Principal Axis Component Loadings by Sex (Varimax Rotation)

	Boys							Girls						
Variables	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Classroom Performance														
Cognitive Memory	92							94						
Divergent	90							83						
Convergent	91							81						
Evaluative	92							81						
Test Data														
Verbal IQ				32	68					40			—67	
Nonverbal IQ					85					—36		—49	—30	53
Uses Flexibility		—53	34		45					42	—57		38	
Consequences Flexibility		—61					37			87				
Consequences S/T				76										90
Sentence Completion														
Self			—79								70	—30		32
Fears						—90					—82			
Time			77						86					
Work Styles		64	43						55	—40				
Family				79					81					
Other People		55				35			86					
Teacher Rating														
Intellectual				38		—49		33		60		—48		
Sociability		—72										—89		
Chronological Age							89						75	
Percent Variance	27	15	13	12	12	12	9	23	19	14	12	11	10	10

in the Group A analysis. This group was composed of students in BAKER-CHARLIE and HAT-IDEA sections. In both Tables 11 and 12 only component loadings of .30 or greater were noted. Component I of the girls and Component II of the boys contained the major loadings for all classroom variables.

The remarkably high loading of all classroom variables on one component came as something of a surprise. It had been supposed that there might be two or more components abstracted from the classroom performance data, with students revealing different cognitive styles and preferences.

However, the common loadings can be explained by the variety of intellectual demands made in the classroom environment. Suppose the divergent thinking question, "What might have happened if the Spanish Armada had won over the British?" were asked. Any student answer to this divergent question must necessarily involve convergent thinking and cognitive memory skills as well. The student must remember what he has previously learned and then reason from the proposition to a conclusion. In addition, evaluative thinking would be included in the student's choice of which answers he deemed appropriate. In other words, the student who wishes to express himself in the classroom is forced to use all the major categories of thinking operations. Once this fact is recognized, it is not unreasonable to expect high intercorrelations among the classroom variables. This is what was obtained.

In the Group A boys (and to a lesser degree the Group A girls) classroom variables were found related to the teacher's ratings of cognitive ability. A number of other variables showed small loadings with the classroom variables in the Group A girls sample. These included a negative loading for the concepts of Faith and Student and a positive loading for Competition. The divergent thinking scores on the Uses and Consequences tests load at a low level on this general expressiveness component for the girls.

Component I for the boys and Component II for the girls loaded heavily on the semantic differential concepts. Of the ten concepts involved in the semantic differential, only Faith in the boys and Imagination in the girls were absent from this component. It may also be noted that in neither the boys' or girls' case does this general component, which might be labeled sanguinity, have any relationship to other variables.

With the boys, Component III was heavily loaded with verbal and nonverbal IQ scores, with a small positive weighting on teacher rating of cognition, as might be expected, and a small loading on the semantic differential concept of Love, which lacks an obvious interpretation.

Component IV for the Group A boys can be labeled the divergent thinking factor, loading heavily on the Consequences and Uses breadth scores as well as chronological age. Divergent thinking performance in the classroom also showed a small loading. While this was an expected result, it was the only one of the four groups in which even such a small relationship was found.

Component V for the boys revealed the Consequences solution score loading highly, with a negative loading on the concept of Love on the semantic differential. In other words, boys who gave a high percentage of solution answers to the Consequences questions were less positive toward the concept of Love. This is a difficult combination to explain.

Component VI for the boys loaded most heavily on the teachers' ratings of sociability of the student. Connected with this was performance on the cognitive memory dimension in the classroom, Uses breadth, and a positive loading for the concept of Imagination. It is to be noted that the teacher separated the ratings on cognition and sociability with the boys, but that these ratings are found on the same component with the girls.

Component VII for Group A boys loaded most highly on Faith, with negative loadings for Imagination; these concepts are antagonistic to one another. The higher status held for the concept of Faith and the lower status of Imagination, an interesting finding, was not repeated in the girls' sample.

Component III for the Group A girls, accounting for 16 percent of the variance, was the IQ factor and was associated with a strong negative loading on chronological age. In other words, the younger girls appeared to have a higher IQ. Also, small negative loadings were found for the concepts of School and Work. This appeared to mean that the higher IQ girls did not rate School and Work as highly as the other girls, who may be considered as having remarkably positive attitudes on these two concepts.

Component IV for the Group A girls represented teacher attitude and ratings. Here again, the teacher tended to rate the older girls more positively. Only minor loadings on the semantic differentials of Student and Faith accompanied the ratings. The teachers saw the girls' cognitive and sociability ratings as closely intertwined.

Component V for the girls obtained its greatest loadings on the semantic differential concept of Imagination. Such loading was also accompanied by a positive attitude towards the concepts of Love, Work, Student, and Father, and a small loading on convergent thinking performance in the classroom. We hasten to point out that having a high regard for the concept of Imagination is not the same as having a productive imagination, and that this component seems more conservative and convergent in total character.

Component VI for the girls was the divergent thinking factor corresponding to Component IV in the boys. Only negative loadings towards the concepts of Love and School may be noted here. High divergent thinking would be expected to show negative loadings to traditional value concepts such as these.

Finally, Component VII for the girls was represented by the solution scores on the Consequences test which did not load substantially or meaningfully with any of the other variables.

In summary, the two components with the largest loadings for both sexes represented classroom performance and semantic differential scores. There are few indications that performance on divergent thinking tests is related to such performance in the classroom. IQ and divergent thinking scores fell in separate factors and neither seemed highly related to the attitudes toward semantic differential concepts. Components IV to VII in both groups accounted for about the same amount of variance with rational interpretation becoming more difficult as the variance contribution became less.

Group B Findings. Table 12 shows the results of the principal axis component loading from the sample of students in the DAN-EASY, FOX-GEORGE, and JACK-KING groups. In this sample, a sentence completion test was used to obtain scores on self concept, attitudes toward family, other people, time, work styles, and fears. Component I for both boys and girls in this group was classroom expressiveness. As in the Group A findings, all of the classroom variables loaded heavily on the same component for both sexes. The teacher's rating of cognitive ability in girls loaded on this component but no variable loaded for the boys on Component I. Component II for the boys accounted for 15 percent of the variance and appeared to be loaded with divergent thinking, highly related to the sociability variable. The teachers rated boys scoring high on divergent thinking tests as most popular--not as the rebel that he has been pictured in other research. Also included in this component was a more negative attitude towards other people and such concepts as imagination and creativity from the sentence completion test.

Component III for the Group B boys carried the highest loadings on self concept. Also associated were less positive attitudes toward future or past events and creativity—imaginative work styles. A positive self image in these boys did not mean positive attitudes toward the other concepts.

Component IV for Group B boys loaded on Consequences solution score and also related to positive attitudes towards family in the sentence completion test and small loadings on verbal IQ and teacher ratings of cognitive ability. Thus, ability to produce solutions to consequences questions was related to a generally positive attitude towards close family and was reflected in other persons' judgments of the boys.

Component V for the boys was the IQ factor which included a small loading from the divergent thinking tests. This was the only time there were positive relationships of a significant nature between IQ and divergent thinking tests.

Component VI for the Group B boys indicated a relationship between absence of fears and positive ratings of intellectual performance by the teacher, a finding which might have been expected. Component VII appears to be mainly a chronological age component.

With the Group B girls Component II seemed to represent the general sanguinity factor found in the Group B boys and girls. However, none of the other variables seem to relate to it. On Component III for the girls the major loadings are for the divergent thinking test with some small loadings on verbal IQ and a positive loading on teacher ratings of cognitive ability. This seems to indicate that girls who show positive performance on divergent thinking tests also do well on IQ tests and are perceived by the teachers as high achievers. Another unusual aspect of this component was the negative loading of nonverbal IQ scores.

On Component IV, positive attitudes toward self appeared, along with an absence of fears. However, the higher the concept of self, the lower the flexibility score on the Uses test, a relationship similar to that found with the boys of this particular group. Does this mean that a certain amount of anxiety and a limited self concept are necessary for extensive production of ideas in divergent thinking?

On Component V, the major loadings were in the area of teacher ratings. The teacher ratings were positively related to nonverbal IQ scores of the youngsters and a slightly positive self concept on the part of the girls. As with the Group A girls, the teachers seemed to see cognitive ability and sociability as being more closely related in girls than in boys.

Component VI was the IQ factor related to chronological age and, in this case, a negative loading between performance on the IQ test and Uses flexibility. None of these weightings are very strong on the Uses flexibility. It is likely that the strong CA loading had an influence on this component.

Component VII, the last factor for the Group B girls, was the Consequences solution score which seems related to performance on nonverbal IQ tests, with no relationship to family attitudes, in contrast to Component IV for the boys.

The failure of the component analyses to yield comparable components in the two groups should signal caution to any attempt to generalize from the present findings. The two groups did have in common a single factor of classroom expressiveness including all measured variables of classroom performance, which in turn, was not related in great degree to other outside variables. Divergent thinking was found to be a component by itself, separated in most cases from IQ scores. There was some indication in Group B that divergent thinking was related more to affective variables than to cognitive variables, a point that will be dealt with in the discussion. There was evidence of different patterns of relationships between the sexes once the first two components were eliminated.

Relationship between Cognitive Performance of Teacher and Student

The percentages of teacher questions in each of the primary categories were ranked from one to ten. In one class, BAKER-CHARLIE, where the teacher was recorded in 20 sessions, the ranking was from 1 to 20.

The same class sessions were ranked by sex in percentage of production in each of the thought categories. For instance, the ten sessions of FOX-GEORGE were ranked in percentage of divergent thinking questions presented by the teacher; these classes were then ranked in percentage of divergent thinking presented by the boys and girls.

The relationships between sets of ranks obtained for each teacher's class sections were measured by a Spearman rank order correlation coefficient. Table 13 indicates a consistently high relationship between

TABLE 13

Spearman Rank Order Correlations of Student Performance versus Teacher Performance

		Cognitive Memory	*Divergent Thinking*	*Convergent Thinking*	*Evaluative Thinking*	*Number of Class Sessions**
Teacher A vs.	Boys	.75	.78	.65	.50	20
	Girls	.58	.72	.48	.47	
Teacher B vs.	Boys	.57	.74	.76	.80	10
	Girls	.57	.08	.43	.38	
Teacher C vs.	Boys	.69	.51	.71	.68	10
	Girls	.90	.71	.91	.55	
Teacher D vs.	Boys	.77	.80	.77	.62	10
	Girls	.77	.62	.48	.43	
Teacher E vs.	Boys	.82	.39	.82	.79	10
	Girls	.88	.60	.83	.56	

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* For $N = 10$, Spearman r's of .56 significant at .05 level (one tailed test)
$N = 20$, Spearman r's of .38 significant at .05 level (one tailed test)

the thought processes asked for by the teacher and the kind given by the student. In most instances, the positive relationship reached a level of statistical significance. In no instance was a negative relationship found. In only one case did the relationship approach zero, when teacher B's request for divergent thinking was related to the divergent thinking production of the girls. A closer examination of these particular class sessions showed that the boys responded most consistently to requests for divergent thinking as shown by an r of .74, whereas the girls appeared somewhat erratic in their responses. With that single exception, no substantial differences appeared between boys and girls in their responsiveness to the type of question asked. In retrospect, this was not surprising. If a teacher asks for the date Lincoln was shot, it would would be difficult for a student to give a divergent thinking response. If a teacher asks for comparative judgment on the communication effectiveness of the novel versus that of the short story it would be hard to avoid an evaluative response. In short, the teacher has dominant control over the type of expressive thought in the classroom. Such a fact presents teachers with special opportunities and special responsibilities.

Consistency of Classroom Expressiveness in Gifted Children over Change of Time, Subject Matter, and Teacher

Table 14 gives an indication of the consistency of classroom expressiveness. A number of the students were recorded at different times in the same class, or in different classes with different content and teacher. In view of the observed relationship between teacher performance and student production, there was some question whether interstudent con-

TABLE 14

Consistency of Classroom Expressiveness in Gifted Students

Cognitive Variable	*Social Studies (Fall) vs. Social Studies (Spring)* ($N = 39$)[*]	*Social Studies vs. Science* ($N = 20$)	*Science vs. English* ($N = 39$)
Cognitive Memory	.40	.66	.60
Divergent Thinking	.31	.31	.44
Convergent Thinking	.37	.58	.46
Evaluative	.54	.45	.52

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[*] For $N = 39$, Pearson r of .30 significant at .05 level
$N = 20$, Pearson r of .43 significant at .05 level (Guilford, 1950b, p. 609)

sistency could be noted from one period to another, or whether student performance depended entirely on the teacher's style.

Data provided by three samples of children were analyzed. The first group contained 39 students from two social studies classes. Two sets of observations were taken with the same teacher; one block of recordings was made in the fall and the other in the spring. A second group of 20 students was observed during social studies and again in science class. A third group of 39 students, originally recorded in science classes, were recorded a year later in English classes.

Pearson product moment correlations were calculated between adjusted class scores in each of the groups. Table 14 shows results of these correlations. One striking fact noted was the positive nature of the correlations. Regardless of the class or the cognitive variable, there was significant student consistency in terms of classroom expressiveness. In other words, despite the clear influence of the teacher on the thought processes, the students still maintained, to some extent, their own consistent styles. As shown by the science versus English comparison, students were consistent even while moving from one class to another, more so than students remaining in the same classes with the same teacher.

Of the four major categories, divergent thinking appeared to have the least stability. This was consistent with the observation that it was the most susceptible of the primary categories to teacher initiation and influence. Cognitive memory, which seemed to be a necessary part of cognitive interchange in any classroom session no matter which teacher or subject was involved, maintained the highest level of student consistency from one time to another.

Daily Consistency of Teacher Student Expressiveness within Class Sections

While Table 14 indicated student consistency in general expressiveness, there was a further question regarding the consistency of the level of expression of various thought processes within a particular class section. In order to calculate whether teachers or students varied from expected level of performance during a five day week, the following procedure was used: a percentage was calculated for each of the thought processes used for each class session. A chi square was obtained using for expected frequency the total percentage for the week divided by five. The null hypothesis stated that if no differences occurred in the proportions of thought processes from one class session to the next, there would be relatively little difference between expected and obtained frequencies for each of the class sessions. The null hypothesis would be rejected if large differences were found between obtained and expected performance.

TABLE 15

Differences by Chi Square on Proportions of Teacher Cognitive Expression within Five Class Sessions

	Teacher Questions				*Teacher Statements*			
Groups	*Cognitive Memory*	*Divergent Thinking*	*Convergent Thinking*	*Evaluative Thinking*	*Cognitive Memory*	*Divergent Thinking*	*Convergent Thinking*	*Evaluative Thinking*
BAKER-FALL	6.26	18.37••	1.08	4.60	4.11	5.17	3.43	5.00
BAKER-SPRING	14.96••	4.43	22.71••	8.44	3.39	4.50	6.70	3.46
CHARLIE-FALL	13.96••	41.80••	14.21••	23.20••	1.93	1.20	2.38	5.50
CHARLIE-SPRING	1.65	12.80•	11.31•	4.50	5.66	4.17	10.58•	7.57
DAN	1.55	17.20••	6.78	9.33	1.25	.50	2.09	19.25••
EASY	6.13	2.50	19.55••	7.60	1.16	4.33	.83	2.62
FOX	23.35••	13.00•	24.12•	4.33	6.47	9.00	24.91••	6.17
GEORGE	9.52•	6.33	14.34••	21.00••	5.67	6.50	20.50••	6.14
HAT	34.55••	37.33••	4.36	31.47••	.93	1.67	4.35	2.18
IDEA	10.24•	16.50••	22.13••	16.83••	1.52	6.75	10.39•	3.50
JACK	31.21••	.00	57.15••	45.37••	5.31	2.00	4.29	8.44
KING	7.14	29.00••	7.44	13.00•	2.10	3.50	1.87	5.92

• Significant at .05 level ($\chi^2 = 9.49$)
•• Significant at .01 level ($\chi^2 = 13.28$)

Table 15 shows chi square findings within the five class sessions (see also Figures 3-8). The results indicate clearly that, regarding types of questions asked by teachers, proportions varied considerably within a particular class. They did not necessarily vary in the same way for each class section. For example, for the teacher in the BAKER section, the divergent thinking questions varied significantly in the BAKER-Fall section, while the cognitive memory and convergent thinking questions varied significantly for the BAKER-Spring section.

Significant differences were obtained on divergent thinking for the DAN section and on convergent thinking for the EASY group. It should be recognized that these results were not independent of one another since they were composed of proportions that added up to 100 percent. A high percentage of divergent questions on a given day inevitably meant that proportions would be lower in the other areas.

The general portrait was clear. Teachers varied question asking from one time to another within the same class, depending upon the goals for a particular session.

When teacher statements were considered, a greater degree of consistency was obtained. In the BAKER-CHARLIE series, only convergent thinking statements made in the CHARLIE-Spring section reached a level of statistical significance. Only in the FOX-GEORGE sections was there some degree of consistency from one class to another. In both sections, there was significant variation in the proportion of convergent thinking statements made in the five sessions. This was probably because teacher explanations necessarily accompanied the science experiments performed only on certain days.

In the JACK and KING sections, the teacher remained consistent in kinds of statements made over the entire five days. This suggests that the teacher's variations in expressive thought relate much more to questions than to statements. Different patterns of classroom operation were seen as relating to kinds of questions asked.

Variation for students, both boys and girls, in the five sessions is shown in Table 16. Chi square was used in the same way as with the teacher data. Question asking and statement making data were combined for reasons previously stated. Wide variation again appeared and, for the boys, especially in divergent thinking. There were significant intersession differences in the BAKER-CHARLIE series, and in one section of each class except for JACK-KING where, it may be recalled, very little divergent thinking was expressed at any time by the boys. In general, the student variations were rather closely tied to variations in teacher questions.

Inspection of the girls' performance suggests that they varied even more from one session to another than did the boys, with a greater num-

TABLE 16

Differences by Chi Square on Proportions of Student Cognitive Expression within Five Class Sessions

	Boys' Statements				*Girls' Statements*			
Groups	*Cognitive Memory*	*Divergent Thinking*	*Convergent Thinking*	*Evaluative Thinking*	*Cognitive Memory*	*Divergent Thinking*	*Convergent Thinking*	*Evaluative Thinking*
BAKER-FALL	28.10••	32.82••	6.26	10.46•	33.95••	57.95••	27.00••	24.50••
BAKER-SPRING	10.48•	10.43•	12.93•	22.87••	34.54••	25.37••	10.54•	25.00••
CHARLIE-FALL	16.84••	27.86••	3.00	7.20	29.31••	33.36••	32.48••	11.08•
CHARLIE-SPRING	1.71	16.13••	4.35	5.75	2.69	14.00••	9.86•	10.40•
DAN	7.59	25.09••	8.92	14.00••	3.30	4.00	11.36•	10.10•
EASY	2.18	8.20	8.89	9.40	6.63	11.67•	12.33•	12.80•
FOX	5.02	12.29•	8.41	5.60	8.27	13.00•	21.87••	6.40
GEORGE	5.98	8.40	8.14	2.25	4.65	9.00	19.44••	4.00
HAT	24.96••	8.79	20.22••	30.27••	36.33••	53.17••	12.29•	42.08••
IDEA	14.56••	11.09•	19.11••	2.73	24.62••	14.00••	28.00••	6.35
JACK	26.57••	3.00	38.27••	21.78••	24.30••	11.00•	33.20••	22.67••
KING	5.07	2.50	9.80•	9.43	.66	11.00•	6.62	32.00••

• Significant at .05 level ($\chi^2 = 9.49$)
•• Significant at .01 level ($\chi^2 = 13.28$)

ber of significant differences obtained across all groups. Again, the relatively few divergent thinking statements made by girls sharpened the differences between expected and obtained performance.

These results indicate that a sample of teacher behavior needs to be relatively comprehensive since it cannot be assumed consistent from one class session to the next, particularly in regard to questions. (The same does not seem true of teacher statements, for the pattern remained relatively consistent except for special circumstances.) Thus, teacher performance must necessarily be observed over a relatively long period of time. The students' cognitive performance reinforces this statement even more strongly. The student performance, in proportion of thought processes, varied by the day and was affected substantially by changing circumstances and class goals. In effect, these results represented statistical confirmation of the variance that was observed.

Factors Influencing Type of Production in Class

Table 17 shows the results of a three way analysis of variance investigating whether teacher performance in the primary thought categories was related to the group, the class section, or day of the week on which the recording took place. A group refers to all students assigned to one teacher, such as FOX-GEORGE or JACK-KING. With five teachers and six groups involved, the degrees of freedom for groups was five. The investigators wished to determine whether significant variation occurred in various areas from one class session to another. Since suggestions had been made that teacher and student styles of performance might be influenced by day of the week, this was also included as part of the total analysis of variance.

Table 17 shows the results of the analysis on teacher questions. Significant differences were obtained on all primary thought categories on the basis of group. This was confirmation of what many observers have indicated, that teachers vary significantly in style of question asking.

For the area of cognitive memory, the level of statistical significance was reached when class sections were compared. As noted in Figure 7, there were particularly dramatic differences in the two social studies sections, HAT and IDEA, which may well account for the significant result by class section. In the productive thinking categories, no significant variations were found due to class section, day of the week, or the interaction among the basic variables. Of the three variables, the difference from one group to another was by far the most significant in accounting for variation in the primary thought categories.

Table 17 also shows analysis of variance using teacher statements as the basis for comparison. In the same way, variations due to group,

TABLE 17

Analyses of Variance of Thought Processes Expressed by Group, Class, and Day

Source	df	*Cognitive Memory* Mean Square	*Cognitive Memory* F	*Divergent Thinking* Mean Square	*Divergent Thinking* F	*Convergent Thinking* Mean Square	*Convergent Thinking* F	*Evaluative Thinking* Mean Square	*Evaluative Thinking* F
Teacher Questions									
Group	5	666.42	5.44**	99.18	3.64*	1391.15	14.58**	201.66	5.93**
Class	1	936.15	7.65*	.00	.00	448.27	4.70	98.82	2.90
Day	4	159.81	1.30	2.37	.10	166.72	1.74	27.81	1.81
Group-Class	5	216.31	1.77	11.02	.40	46.31	.48	43.50	1.28
Group-Day	20	261.91	2.14	29.13	1.06	191.56	2.01	29.50	.87
Class-Day	4	107.36	.87	29.89	1.10	31.72	.33	68.69	2.02
Residual	20	122.42		27.19		95.41		34.02	
Total	59								
Teacher Statements									
Group	5	533.54	17.98**	37.31	14.51**	94.31	3.72*	108.51	7.81*
Class	1	132.02	4.45	4.27	1.66	38.40	1.52	7.35	.53
Day	4	85.40	2.88	1.44	.56	64.12	2.53	15.75	1.13
Group-Class	5	76.82	2.59	3.15	1.22	16.92	.67	54.51	3.92*
Group-Day	20	70.42	2.37	5.43	2.11	37.86	1.50	24.41	1.76
Class-Day	4	56.77	1.91	9.64	3.75*	28.19	1.11	28.43	2.05
Residual	20	29.67		2.57		25.31		13.89	
Total	59								

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* = $p < .05$
** = $p < .01$

class section, and day of the week were considered together with all of the interactions of these variables. The results were somewhat similar to those found in analyzing teacher questions. Significant variation was found among groups on all of the primary thinking processes, but no significant variance was found between class sections for any of the thought operations. Neither were there significant variations due to the day of the week.

Two significant interactions were obtained. One related to the combination of class session with the day of the week in divergent thinking, and another, in evaluative thinking, to combining group with class sessions. It was felt that the small number of certain types of statements by some teachers made this significant interaction possible by unduly weighting the day of the week when this series of responses occurred. No clear explanation can be given for the interaction between group and class on evaluative thinking except the suggestion that the make-up of the youngsters in the class molds the behavior of the teacher and forces the teacher to modify style to allow for student idiosyncracies.

Table 18 indicates the analysis of variance on the boys' statements for the four major areas of thought processes by group, class section, and day. Significant differences were found in the areas of divergent thinking and convergent thinking by group, again underlining the differences among groups. Two significant differences were found due to the class section in the areas of cognitive memory and evaluative thinking. It will be recalled that in analysis of teachers' statements and questions (Table 17) there were significant differences by class section in cognitive memory questions and in evaluative thinking statements. The finding of potential influence of the teacher upon the kinds of statements made by the students is thus supported. Again, neither the day of the week nor the interactions revealed significant variance influences.

Table 18 also shows the analysis of variance obtained on thought processes of the girls. Results were consistent with the responses of the teachers and the boys in that the main significant variance was obtained between groups. In the girls' case, neither the section nor day of the week had significant influence, nor were significant interactions found among the major variables.

In total, the major variance in expression of kinds of thought processes related most strongly to the specific group, which in this case meant the particular teacher. Occasionally, the membership of a class section appeared to influence the kind of expressive thoughts of teacher and boys, but not of girls. Day of the week was not significant nor was variable interaction particularly impressive for student or

TABLE 18

Analyses of Variance of Thought Processes Expressed by Group, Class, and Day

Boys' Statements

Source	df	Cognitive Memory Mean Square	Cognitive Memory F	Divergent Thinking Mean Square	Divergent Thinking F	Convergent Thinking Mean Square	Convergent Thinking F	Evaluative Thinking Mean Square	Evaluative Thinking F
Group	5	319.15	2.90	530.42	12.52**	931.39	14.76**	109.71	5.78
Class	1	1306.67	11.87**	40.02	.94	340.82	5.40	123.27	6.50*
Day	4	96.56	.88	3.43	.10	67.90	1.08	50.19	2.64
Group-Class	5	134.22	1.22	27.22	.64	84.78	1.34	39.54	2.08
Group-Day	20	226.15	2.05	74.78	1.76	133.84	2.12	26.93	1.42
Class-Day	4	61.08	.55	36.60	.86	76.15	1.20	52.89	2.79
Residual	20	110.04		42.35		63.11		18.97	
Total	59								
Girls' Statements									
Group	5	1083.56	7.46**	627.55	8.71**	890.83	8.06**	188.12	3.91*
Class	1	26.67	.18	17.07	.24	2.40	.02	.27	.00
Day	4	169.97	1.17	30.47	.42	55.39	.50	37.81	.78
Group-Class	5	157.02	1.08	7.51	.10	133.96	1.21	50.47	1.04
Group-Day	20	309.14	2.13	85.51	1.19	139.40	1.26	36.33	.75
Class-Day	4	257.21	1.77	75.44	1.05	167.44	1.51	22.56	.46
Residual	20	145.17		72.03		110.55		48.16	
Total	59								

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* = $p < .05$

** = $p < .01$

teacher questions, although some interaction was found in the teacher statements in divergent thinking and evaluative thinking.

Sex as Relevant Variable in Classroom Expressiveness and Other Comparisons

Table 19 shows results of comparing boys and girls in amount of cognitive expressiveness related to the various thought categories in the six sets of recordings. The mean scores in Table 19 represent the average number of responses made in each of the four major categories during the five consecutive sessions.

A casual perusal of the table shows that generally the boys were more expressive than the girls over all categories. However, such a statement needs qualification. The BAKER-CHARLIE Spring group had nearly the same members as the BAKER-CHARLIE Fall classes. The spring data is really an indication of the stability of the fall observations and should not be considered data on a new group. In the BAKER-CHARLIE Fall group, clear differences between boys and girls were found in favor of boys' expressiveness in all areas except evaluative thinking. However, the boys appeared superior in the evaluative category in the spring sample.

Some of these same youngsters (BAKER-CHARLIE) were in the DAN-EASY group and may well have been responsible for some of the significant differences shown in Table 19 for the DAN-EASY group.

The FOX-GEORGE group, however, was a completely new set of students. The data indicate that the boys were significantly more expressive than the girls in every area. Even in the categories of evaluative thinking and divergent thinking, infrequently called for by the FOX-GEORGE teacher, the boys dominated the few statements made.

The HAT-IDEA social studies classes, theoretically similar to the BAKER-CHARLIE groups, did not show the same superiority of boys in expressiveness, despite the fact that these students were at the same age level as the BAKER-CHARLIE group and presumably from the same general population. Only in the area of divergent thinking were differences found in favor of the boys. While this supported the general notion that boys were more inclined to divergent thinking, the difference in total expressiveness was negligible.

In the JACK-KING group, there were significant differences in favor of the boys' expressiveness in the areas of cognitive memory, evaluative thinking, and in total responses. There was also a tendency for boys to be more expressive than girls in divergent and convergent areas, but these differences did not reach expected levels of statistical significance.

Within the limits stated above, there was sufficient evidence to state that boys tend to be more expressive in the classroom in all of the pri-

TABLE 19

Verbal Classroom Expressiveness in Gifted Groups by Sex

Groups	Cognitive Memory Mean	Cognitive Memory S D	Divergent Thinking Mean	Divergent Thinking S D	Convergent Thinking Mean	Convergent Thinking S D	Evaluative Thinking Mean	Evaluative Thinking S D	Total Mean	Total S D
BAKER-CHARLIE Fall										
Boys ($N=23$)	16.78**	9.94	9.00**	5.74	7.43**	4.91	3.35	3.25	36.56**	19.15
Girls ($N=20$)	9.50	3.95	5.30	3.89	4.80	3.09	3.15	2.60	22.75	10.97
BAKER-CHARLIE Spring										
Boys ($N=22$)	26.27**	16.62	7.86**	5.60	11.14**	5.95	5.41**	4.24	49.77**	26.20
Girls ($N=17$)	11.59	9.17	4.12	4.00	6.06	4.75	2.23	3.13	26.00	18.39
DAN-EASY										
Boys ($N=14$)	27.71**	21.45	4.35**	4.94	8.71**	5.73	1.71*	2.13	40.57**	27.93
Girls ($N=19$)	12.84	11.03	.81	.99	2.58	2.93	.58	.69	16.95	14.08
FOX-GEORGE										
Boys ($N=28$)	25.36**	27.30	3.25**	3.58	21.14**	22.30	2.25**	2.43	52.00**	53.67
Girls ($N=28$)	10.82	15.76	1.00	2.00	6.64	11.22	.54	1.32	19.00	29.25
HAT-IDEA										
Boys ($N=24$)	16.04	12.67	4.88*	5.07	6.33	6.36	3.42	3.02	30.66	24.21
Girls ($N=16$)	17.44	10.81	2.81	2.20	5.69	5.63	3.63	3.59	29.56	20.16
JACK-KING										
Boys ($N=23$)	14.52*	15.04	.52	.73	10.09	9.05	2.26*	2.58	26.52*	23.57
Girls ($N=25$)	7.52	9.92	.32	.63	6.60	7.78	1.04	1.67	15.48	18.84

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*$p < .05$

**$p < .01$

mary categories than do girls. In no single instance in this study did the girls even approach statistical significance in manifesting greater expressiveness than the boys in any category. However, since factors relating to classroom expressiveness are obviously many and varied, it should not be expected that every class or group would show the same results.

Since there was considerable overlapping of membership among groups, a further step was taken to determine if there were true sex differences in classroom performance over the entire sample. In order to equate performance in various classrooms, since there was a wide diversity of production from one class to another, a weighted score for each student was determined. Each student's total production for the five day period was divided by the total output of his class and then multiplied by one thousand to eliminate decimals. An index score of the proportion of the cognitive memory responses, divergent thinking responses, etc., given by each student was obtained. When a student appeared in more than one group, results of performance in the first group were used.

The results of this analysis (Table 20), comparing 79 girls and 86 boys, were quite unequivocal. On all primary thought categories, the boys were found to be more expressive in the classroom than the girls. On evaluative thinking the difference obtained was beyond the .05 level of significance, but beyond the .01 level for the other three areas. As far as the present sample was concerned, it can be stated that gifted boys were more expressive in all thought dimensions than the girls in the classroom discussion environment.

Table 21 shows sex differences in the current population on test measures and teacher ratings. Results are divided into Groups A and B on the basis of age and different measures in the attitudinal area.

TABLE 20

Comparison of Boys' and Girls' Adjusted Scores on Classroom Performance

	Girls ($N=79$)		*Boys* ($N=86$)			
	Mean	*SD*	*Mean*	*SD*	*t*	*p*
Cognitive Memory	27.24	25.60	42.60	34.64	3.23	$<.01$
Convergent Thinking	26.48	29.33	47.16	41.32	3.71	$<.01$
Divergent Thinking	26.02	32.26	52.56	52.16	3.94	$<.01$
Evaluative Thinking	31.16	37.59	43.90	42.74	2.02	$<.05$

TABLE 21

Sex Differences on Test Measures and Teacher Ratings

		Group A				*Group B*			
		Girls ($N = 36$)		*Boys* ($N = 47$)		*Girls* ($N = 56$)		*Boys* ($N = 50$)	
Measures		*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
CA in Months		147.33	4.88	147.26	4.24	163.09	7.09	163.62	7.24
Verbal IQ		130.56	10.17	131.53	9.51	129.38	10.15	129.76	8.18
Nonverbal IQ		125.75	11.22	129.68	9.43	129.18	11.89	131.86	10.63
Uses Breadth		15.92	3.67	17.19	3.73	21.04	7.36	22.56	6.58
Consequences Breadth		13.28	3.00	14.00	3.76	13.80	3.16	13.64	4.09
Consequences Solutions		43.28†	19.25	35.79	18.87	45.89•	13.88	39.78	16.40
Mothers	(Semantic Differential)	72.78	5.08	71.53	6.82				
Fathers		71.83†	8.83	67.74	10.03				
Students		70.44†	8.58	66.94	9.27				
Work		67.06	9.15	67.21	8.20				
Competition		67.75	8.62	65.98	12.40				
Success		67.92	9.30	64.15	11.91				
Love		71.61	7.44	70.13	10.95				
Faith		71.67	7.61	71.34	7.78				
Imagination		71.42•	6.58	66.81	12.02				
School		69.47	8.17	69.19	10.57				
Self	(Sentence Completion)					23.32•	3.82	20.08	8.82
Fears						4.05	1.27	3.92	1.23
Time						5.89	1.81	6.16	1.82
Work Style						12.98	2.96	12.38	3.01
Family						12.95†	3.43	14.10	2.72
Other People						13.32•	3.40	14.52	2.29
Cognition	(Teacher Rating)	11.42	3.86	11.87	3.69	11.07†	4.33	9.68	3.63
Sociability		2.22	.68	2.34	.89	1.84••	.65	2.24	.80

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† $p < .10$ • $p < .05$ •• $p < .01$

As reported in the earlier tables, there were no meaningful differences between the sexes in verbal or nonverbal IQ, with the average score on group intelligence test measures well into the expected range for a gifted population. The results on divergent thinking were of particular interest since this appeared to be one of the more decisive areas of difference. The question was whether this observed classroom difference was due to differences in basic thinking abilities of boys and girls, or rested in the greater willingness of the boys to express ideas, with a greater role expectation for aggressive performance in class. If basic differences were in thinking ability, the boys should be superior both in classroom expression and in paper and pencil tests of divergent thinking; but if role expectation were the determining factor, no sharp differences should be found between the sexes on the written tests.

The evidence suggests that the latter explanation has some merit. There were no significant boy versus girl differences between the mean breadth scores on the Uses and Consequences tests in either Group A or B. However, differences approaching significance were obtained for both groups on the Consequences solutions scores. In both groups, the girls contributed a significantly greater proportion of solutions than did the boys. Solutions represent a more intellectually mature response, and in this area, the girls seemed superior.

On the measures of attitude and self concept, the results were fairly consistent with previous studies on sex differences. In group A, with the use of the semantic differential, the girls appeared more positive toward most concepts than did the boys. Since the highest positive score obtainable was 84 and the midpoint score was about 50, it can be seen that all groups scored in a strong positive direction. However, Group A girls were significantly more positive at a probability level of .10 on the concept of Fathers and at the .05 level on the concept of Imagination. The boys rated the concepts of Competition and Success less positively than concepts of Faith and Mother. No significant difference was found, however, between the boys and the girls of Group A in the teacher ratings of cognition or sociability.

In Group B, on the sentence completion measures, significant differences were obtained between boys and girls in three of six general areas. Since low scores represented a positive orientation, the girls appeared to have significantly lower self concepts, feeling less positive about themselves than did the boys. On the other hand, the girls were more positive towards family and other people. No differences were found in number of fears, time orientation (positive attitude to future or past), or attitude toward concepts such as Creativity and Competition. In a sense this confirmed some of the semantic differential results obtained for Group A, suggesting that the girls were slightly less sure of themselves than were the boys, but more positively oriented towards other people. Teacher ratings ranked the girls as significantly better than the boys in the social orientation dimension at a probability level beyond .01. On the other hand, the teachers rated the boys better in cognition with the difference significant at the .10 level.

Another factor that may have been related to differences in teacher ratings in Groups A and B was subject matter. Group B classes were concerned with science and English grammatical structure, whereas Group A was composed of social studies classes. Based on general observation, a case could be made that the girls responded better, cognitively, in social studies than in science and English. Thus, in the cognitive dimension, a better rating for the boys would be expected from the science and English teachers.

Overall, the results strongly indicated significant sex differences in many of the variables included in the present study. Major differences seemed to lie in the attitudinal and self concept dimensions, but attitudes towards self and others played a role in classroom performance. It appears that the observed differences apparently related more strongly to attitudinal and motivational factors than to basic cognitive differences.

Subgroup Differences in Cognitive Styles

The highly publicized report of Getzels and Jackson (1962) and replications by Torrance (1959) have generated considerable interest in the "divergent thinker." The present project offered an opportunity to add data to the general question of differences in cognitive style. The procedure used to select the students was slightly different from that used by Getzels and Jackson, and Torrance. In each class section, children were ranked in order of their performance on measures of divergent thinking (Uses and Consequences breadth scores) and on IQ tests. Each class was divided into a top third, middle third, and bottom third in performance on these measures. Students in the top third on IQ scores but in the bottom third on divergence scores were placed in the high IQ—low divergence group. Similarly, those who scored in the top third on divergence but in the bottom third in IQ were placed in the low IQ—high divergent group. Numerous critiques of the original work by Getzels and Jackson have suggested that any such comparison should include the high IQ—high divergent group, which should represent the most desirable cognitive pattern. This third group was added to include youngsters in the top third on both IQ and divergent thinking.

These stringent requirements, plus the division on the basis of sex, resulted in smaller but more defensible subgroups. Divisions of the sample by sex were necessary because differential results were obtained on that variable.

While some evidence exists as to differences in test performance or teacher ratings of students with various cognitive styles, no evidence has been related to differential classroom performance. Table 22 shows the relationship of cognitive style and classroom performance in the four primary categories. The significant differences were obtained by the Mann-Whitney *U* test (Siegel, 1956), since the small *N* and wide variations argued against use of the *t* test.

No significant differences, or differences approaching significance, were obtained on any of the cognitive style subdivisions among the boys. In other words, whether the boy was classified as high IQ—high divergent, low IQ—high divergent, or high IQ—low divergent made no difference in his performance on any of the major dimensions.

The same cognitive style classification among the girls, however, made a substantial difference. Although there were no differences among the three groups of girls on cognitive memory expression, the high IQ—high divergent girls were significantly more expressive than the high IQ—low divergent girls in the three areas of divergent, convergent, and evaluative thinking. This appeared reasonable on the basis of the a priori expectation that the high IQ—high divergent girl would have the best traits of both dimensions and be the more effective student. This was not the case among the boys.

In the comparison of high IQ—low divergent girls with low IQ—high divergent girls only one significant difference was obtained. Surprisingly enough, this was not in divergent thinking, as one might expect, but in convergent thinking, with the girls classified low IQ—high divergent significantly more expressive than high IQ—low divergent girls. Another difference was noted between the high IQ—high divergent and the low IQ—high divergent groups: the dimension of high IQ seemed to influence the amount of evaluative thinking.

On the basis of these and other data collected in this study, the relationship of cognitive style to classroom and test performance obviously has to be qualified according to sex.

Table 23 indicates the differences among the different cognitive style groups based on teacher ratings of cognitive ability and sociability. All groups obtained favorable ratings in both areas. A midpoint score on the scale of cognitive abilities was 15 and a midpoint score on the scale of sociability was 2.5. The mean scores of all the subgroups were considerably lower than the midpoint (the lower the score, the more favorable the rating).

TABLE 22

Cognitive Style Related to Classroom Performance by Adjusted Classroom Scores

		Boys			Girls				
Classroom Expressiveness		*High IQ— High Divergent (N = 9)*	*High IQ— Low Divergent (N = 10)*	*Low IQ— High Divergent (N = 14)*	*High IQ— High Divergent (N = 10)*		*High IQ— Low Divergent (N = 11)*		*Low IQ— High Divergent (N = 14)*
Cognitive Memory	Mean	59.33	52.10	51.21	54.60		34.18		47.36
	SD	65.62	39.09	45.23	48.68		29.92		37.54
Divergent Thinking	Mean	66.11	49.50	51.00	87.60	**	19.18		33.71
	SD	47.37	35.60	80.38	77.78		24.97		46.27
Convergent Thinking	Mean	61.02	59.60	48.64	81.60	**	16.00	*	47.36
	SD	58.48	43.93	45.33	62.55		15.14		44.39
Evaluative Thinking	Mean	55.56	52.90	66.50	92.90	*	33.45		34.93*
	SD	42.27	49.80	91.49	122.68		53.11		52.34

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*Significant at .05 level
**Significant at .01 level

TABLE 23

Differences between Cognitive Style Groups by Teacher Ratings on Cognition and Sociability

			Teacher Ratings			
			Cognitive Abilities		*Sociability*	
Cognitive Style Group	*Sex*	*N*	*Mean*	*SD*	*Mean*	*SD*
High IQ—High Divergent	Boys	9	10.44	3.08	2.22	1.09
	Girls	11	9.00	1.73	1.64	.81
High IQ—Low Divergent	Boys	10	8.10	3.17	2.10	.74
	Girls	11	10.91	5.02	2.09	.83
Low IQ—High Divergent	Boys	14	11.21	5.03	2.21	.17
	Girls	14	11.57	3.58	2.07	.83

Differences beyond .05 level between:
High IQ—High Divergent Girls vs. Low IQ—High Divergent Girls on Cognition
High IQ—High Divergent Girls vs. High IQ—High Divergent Boys on Sociability

Differences between .10 and .05 level:
High IQ—Low Divergent Boys vs. Low IQ—High Divergent Boys on Cognition
High IQ—Low Divergent Boys vs. High IQ—Low Divergent Girls on Cognition

Nevertheless, the comparison of subgroups by the *t* test revealed certain differences. On the basis of the work by Getzels and Jackson, it was thought that one expected difference would be a more favorable rating for the high IQ—low divergent than for the low IQ—high divergent youngster. As can be seen in Table 23, these tendencies occurred in the case of the boys. The difference obtained was between the probability levels of .10 and .05 in the direction of the more favorable attitude for the high IQ—low divergent boy, and this group of boys also rated more favorably on cognitive abilities than the girls in this same category. The boys' ratings on cognitive performance seemed as high as possible.

At an even more significant level, differences were found between the high IQ—high divergent girls and two other subgroups. They received higher ratings on cognitive abilities than the low IQ—high divergent girls and were rated at a higher level of sociability than the high IQ—high divergent boys. In general, girls in the presumed ideal category of high IQ—high divergent were rated highly by the teacher on both cognitive and sociability levels; the high IQ—high divergent boys were rated less favorably. The high IQ—low divergent boys received the most effective rating on cognition while the low IQ—high

TABLE 24

Comparison of Cognitive Style Subgroups on Semantic Differential

	Boys						*Girls*					
	High IQ— High Divergent (N = 9)		*High IQ— Low Divergent (N = 10)*		*Low IQ— High Divergent (N = 13)*		*High IQ— High Divergent (N= 11)*		*High IQ— Low Divergent (N = 9)*		*Low IQ— High Divergent (N = 14)*	
Concepts	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
Mother	74.33	7.33	† 68.60	6.80	72.69	6.51	71.18	5.25	• 75.78	2.44	73.86	5.66
Father	72.89	5.75	† 66.50	9.54	69.23	10.57	70.18	10.10	75.33	5.12	71.14	10.17
Student	67.22	6.51	64.00	11.86	68.08	9.38	66.81	9.06	71.78	6.63	68.79	8.99
Work	65.11	6.75	† 56.70	12.31	• 69.08	7.39	64.55	7.03	68.78	5.91	67.07	10.19
Competition	71.44	10.33	68.20	8.26	66.23	9.51	70.36	7.61	69.89	4.57	68.64	8.03
Success	67.11	8.52	62.80	10.09	69.77	10.64	68.00	9.53	70.00	6.98	70.36	9.37
Love	67.11	12.42	67.50	10.44	66.54	12.39	69.91	6.92	73.11	6.07	69.36	7.34
Faith	69.67	6.82	66.10	9.68	71.62	7.22	71.91	11.48	75.00	5.89	73.79	7.36
Imagination	66.00	6.22	62.50	12.42	67.77	10.78	67.73	8.17	68.44	3.94	67.21	9.52
School	66.56	14.77	65.30	7.94	69.46	6.62	71.00	8.46	73.78	6.26	70.64	7.74
Total	68.74	9.01	64.82	10.15	69.46	9.15	69.16	8.42	72.19	5.86	69.66	10.35

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† $p < .10$ High IQ—High Divergent > High IQ—Low Divergent on concepts of Mother, Father, Work

• $p < .05$ Low IQ—High Divergent > High IQ—Low Divergent on concept of Work

• $p < .05$ High IQ—Low Divergent > High IQ—High Divergent on concept of Mother divergent boys received lower ratings in both cognition and sociability.

Table 24 compares cognitive style subgroups on the semantic differential scale. Differences and some consistent trends were noted, despite the small samples. With the boys, there was a significant difference between the high IQ—low divergent group and the other two subgroups on the concept of Work. Of all concepts, Work received the lowest mean rating by a large margin for the high IQ—low divergent group. The same group was also less favorably inclined on the concepts of Mother and Father than were the high IQ—high divergent group. This difference was obtained only at the .10 level of significance but was surprising in view of the expectation that the high divergent children would be more negative toward school and traditional elements in society, including family members. These expectations were not realized with the low IQ—high divergent groups either.

No differences were obtained between the high IQ—high divergent and the low IQ—high divergent groups. For the boys, the characteristic of divergence, whether low or high, determined the few differences obtained.

Of the ten subscales, the high IQ—low divergent group obtained a higher mean score than the low IQ—high divergent group on only two concepts, Competition and Love. Perhaps this fits into a general pattern: high IQ—low divergent boys see the world as a rather harsh place where competition thrives and where hard work is necessary to reach one's goal. However, one does not have to like work as a consequence.

In comparison, only one difference was found among subgroups of girls. The high IQ—low divergent group was significantly higher in ratings of Mother than were the high IQ—high divergent groups. The high IQ—low divergent group tended to have slightly higher mean scores than the other two groups on other concepts. No differences were obtained in comparisons of high IQ—high divergent and low IQ—high divergent girls.

It can be concluded that the minor differences on the semantic differential centered around attitudes toward parents and towards the concept of Work. Other presumed relevant concepts such as School, Imagination, Student, and Success brought forth no important differences.

Differences between Expressive and Nonexpressive Students

Since the component analyses suggested that only the one component was related to classroom expressiveness, an attempt was made to differentiate students on this basis by comparing the top third of the sample with the bottom third in classroom expressiveness on a number of different variables. Expressive and nonexpressive students were compared on cognitive factors and teacher ratings (Table 25). In general, differences found on measures of cognitive performance were small or inconsequential. There was a difference at the .10 level of confidence on verbal IQ, with the more expressive boys tending to obtain a higher verbal IQ score than the nonexpressive boys. With the girls, however, no differences were found on this variable.

Although the traditional levels of statistical significance were not reached on the solutions score on the Consequences test, there was a difference in direction. The most expressive boys gave the greater number of solutions on the Consequences test, while the most expressive girls gave fewer solutions than their nonexpressive counterparts.

In the area of teacher ratings of cognitive ability, significant differences were found between the expressive and nonexpressive for both the boys and girls. Expressive youngsters were given higher ratings on cognitive ability. It can be argued, of course, that this very expressive-

TABLE 25

Comparison of Expressive and Nonexpressive Gifted Students on Cognitive Factors and Teacher Ratings by Sex

			Expressive			*Nonexpressive*	
Variables	*Sex*	*N*	*Mean*	*SD*	*N*	*Mean*	*SD*
Verbal IQ	Boys	27	133.00†	9.56	27	128.44	7.93
	Girls	27	128.22	10.46	29	127.24	9.36
Nonverbal IQ	Boys	27	129.33	7.62	27	129.89	8.45
	Girls	27	128.81	11.14	29	127.69	11.21
Uses Breadth	Boys	26	21.58	6.46	27	19.67	5.53
	Girls	27	19.96	8.03	29	17.48	5.67
Consequences Breadth	Boys	26	15.00	3.90	27	14.11	3.47
	Girls	27	13.78	2.65	29	13.48	2.89
Consequences Solutions	Boys	26	39.88	18.81	27	31.78	19.22
	Girls	27	41.04	20.05	29	47.52	17.82
Teacher Rating (Cognition)	Boys	26	8.65••	3.39	27	11.74	4.11
	Girls	27	10.56•	3.77	29	12.86	4.57
Teacher Rating (Sociability)	Boys	26	2.31	.79	27	2.41	.93
	Girls	27	2.00	.62	29	2.00	.76

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†Significant at .10 level
•Significant at .05 level
••Significant at .01 level

ness in class influenced the teacher's judgment. However, the teacher's favorable rating did not carry over into the sociability dimension. No differences were found between the groups on social success and no trends noted. Overall, the differences found on cognitive factors between expressive and nonexpressive youngsters were not very impressive.

Expressive and nonexpressive students were compared on the semantic differential scale (Table 26). Again, substantial sex differences were noted. With the girls, differences were obtained on only one item

TABLE 26

Comparison of Expressive and Nonexpressive Gifted Students on Semantic Differential Scale

			Expressive			*Nonexpressive*	
Concepts	*Sex*	*N*	*Mean*	*SD*	*N*	*Mean*	*SD*
Mother	Boys	25	68.84	6.18	26	74.26••	5.41
	Girls	25	72.32	5.93	28	72.17	5.18
Father	Boys	25	66.36	9.40	26	70.50	7.93
	Girls	25	70.16	8.49	28	70.25	7.30
Student	Boys	25	63.88	9.71	26	65.34	7.51
	Girls	24	67.12	7.75	28	67.89	7.26
Work	Boys	25	63.60	6.54	26	67.73†	8.20
	Girls	25	66.56	7.87	28	64.92	8.66
Competition	Boys	25	66.28	9.32	26	67.61	13.77
	Girls	25	69.04•	6.57	28	64.53	8.85
Success	Boys	25	59.72	11.76	26	70.84••	8.07
	Girls	24	66.83	9.20	28	67.50	8.58
Love	Boys	25	66.76	9.81	26	70.65	9.02
	Girls	25	69.80	7.07	28	68.42	7.18
Faith	Boys	25	67.72	9.14	26	72.11	9.06
	Girls	25	76.66	8.29	28	73.17	7.60
Imagination	Boys	25	66.60	7.31	26	62.15	14.72
	Girls	25	68.96	9.63	28	65.85	7.39
School	Boys	25	65.72	10.40	26	71.69•	7.20
	Girls	25	70.24	7.10	28	68.46	7.52

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†Significant at .10 level
•Significant at .05 level
••Significant at .01 level

—Competition. This suggested that the girls with better feelings toward competition are more able to interact verbally in the classroom. With boys, differences were found on the concepts of Mother, Success, School, and Work, all in the same direction, with the nonexpressive students producing significantly higher ratings. Since the mean neutral score was 49, it could not be said that the expressive group was rating these concepts negatively, but they were less positive in attitudes. One plausible explanation of these sex differences is that expressive boys have more self confidence and self assurance and thus are not inclined to give extremely positive ratings on these concepts. Possibly students less sure of themselves and less inclined to make independent judgments rate concepts such as Mother and School highly positive.

Table 27 shows the comparison between expressive and nonexpressive students in performance on the sentence completion test. A low score represents a positive performance. With the girls, two differences were found: the expressive girls had (a) a more positive self concept and (b) a more positive attitude toward concepts such as Imagination, Competition, and Creativity. This result supports the notion that the

TABLE 27

Comparison of Expressive and Nonexpressive Gifted Students on the Sentence Completion Test

Sentence Completion Variables			*Expressive*			*Nonexpressive*	
	Sex	*N*	*Mean*	*SD*	*N*	*Mean*	*SD*
Self	Boys	24	21.41	4.15	27	20.92	4.16
	Girls	24	20.96†	4.13	29	23.21	4.13
Fears	Boys	24	3.91	1.53	27	3.74	1.20
	Girls	24	3.88	1.15	29	4.28	1.25
Time	Boys	24	6.50	2.22	27	5.96	1.56
	Girls	24	5.67	1.63	29	5.68	1.91
Work Style	Boys	24	12.00	3.45	27	10.74	2.86
	Girls	24	10.50••	2.90	29	12.89	3.06
Family	Boys	24	13.41••	3.33	27	11.15	3.74
	Girls	24	10.92	3.56	29	12.44	3.74
Other People	Boys	24	14.20	4.29	27	14.30	2.44
	Girls	24	13.25	2.29	29	13.62	2.99

† Significant at .10 level
• Significant at .05 level
•• Significant at .01 level

expressive girls possessed more positive self concepts and self assurance, enabling them to perform effectively in class even when expressiveness was not part of the perceived feminine role. Only one difference was found in the boys, again consistent with the semantic differential results. The expressive boys were not as positive in their attitudes toward their families as were the nonexpressive boys. There was a hint that dependency relationships in the nonexpressive boys may hinder them from entering into the competitive environment of classroom interaction. Although differences on family ratings were not significant, the direction of differences for the girls was the reverse of that for the boys, with expressive girls leaning in a more positive direction toward their parents. This supported the idea that it is the well adjusted, well rounded girls who participate in classroom interaction.

Family Data

As part of the overall project investigating the productive thinking of gifted students in the classroom, an associated study was conducted on the relationship between parental attitudes and the classroom behavior of these gifted students (Jenné, 1965).

Comprehensive questionnaires were sent to the parents of the students. Each parent was asked to complete the questionnaire independently of spouse. Eighty-seven percent of the mothers and 80 percent of the fathers completed the questionnaires. The questionnaire asked for data on demographic variables such as number, sex, and birth order of children; age of family members; date of marriage; education of parents; religious preference; father's occupational history; and mother's employment since marriage. Information was also obtained on parental involvement with the school (e.g., PTA attendance, extent of personal contact with teachers), attitudes on child rearing, family interpersonal relationships, family values, etc. This information was then related to the classroom and test data.

Farber's (1962) Index of Marital Integration was used to provide both a quantitative measure of marital integration and an indication of qualitative aspects of family organization. To assess parental child training practices, particularly achievement inducing and independence granting, a modified version of Torgoff's (1960) Developmental Timetable was used. The Life Goals and Behavior Choices instruments were used to assess parental aims and goals relating to socialization of the child.

Few clearcut relationships were found between parental attitudes and classroom behavior or test performance. One trend noted was that parents of divergent boys appeared more controlling, while the parents of divergent girls were less controlling than average for this sample.

This finding was tentatively interpreted as suggesting that in order to stimulate maximum divergent thinking, parents must be in conflict with the prevailing norms. This difference would be marked by their encouraging more constructively aggressive behavior in girls and by channeling, through greater control, the aggressive behavior already permitted to boys.

The lack of substantial relationships between the two sets of variables, however, may have been due to the relative homogeneity of the samples (predominantly highly educated, middle class) or the problems with instrumentation (attitude measurement being an inexact science, to say the least); or it may reflect a true situation, i.e., that there really are few relationships between parental attitude and this kind of child behavior. Further research is needed to clarify the interesting questions posed.

5

Discussion and Implications

The results of this project have implications along a number of dimensions: cognitive structure and process, cognitive style, the development of measuring instruments, sex differences, and the teaching environment of the classroom. Each of these will be discussed.

Cognitive Structure and Process

The experience of the project strongly supported the need for a theoretical model from which to organize and process information. Without a model such as Guilford's structure of intellect it would have been difficult to make any sense of the vast amount of complex information gathered. At the same time, the use or application of such a model often raises certain doubts about the completeness or appropriateness of the model itself. Theories of behavior developed in the laboratory depend to a large extent on how well they deal with the more complex relationships outside of the laboratory. Guilford (1958) fully recognized such complexity in discussing the creative process.

> No creation takes place in a vacuum. We cannot create unless we have the background of information with which to create. This implies a history of cognitions and of memory for those cognitions. Furthermore, to be completely effective as a creative person, one must exert some degree of evaluation. Too much evaluation applied too early is, of course, detrimental but there is one special role of evaluation that must be pointed out. The act of evaluation leaves us satisfied with our results or it leaves us dissatisfied. If we are too easily satisfied we miss opportunities for making important corrections and improvements and the general opportunity to grow (p.6).

As noted earlier, doubts were raised about the legitimacy of claiming that different mental operations were required for the dimensions of convergent and divergent thinking. For example, a student is shown a balloon in a bell jar. The laboratory assistant manipulates some type of valve and the balloon alternately gets larger and smaller.

Convergent Question	*Divergent Question*
Why does the balloon get smaller?	How many different solutions can you produce to explain what you see?
Student Answer	*Student Answer*
If the balloon's size is determined by pressures internal and external to its surface	Air is being pumped out of the bell.
And the balloon is changing size	A heavier gas is being pumped inside the balloon.
Then the pressure on the outside of balloon must be changed	It is an optical illusion.
Therefore the lab assistant must be manipulating air pressure within the bell jar.	There is another balloon within the first balloon that is being manipulated.

It should be clear that each of the answers to the divergent questions are merely the "therefore" statements of a logical syllogism of the same type that was spelled out to answer the convergent question. The mental operation the student must perform with the information is of precisely the same order in both questions, but on the divergent question he is asked to do it more than once. In a very real sense, the responses to divergent thinking questions are products for which the mental process has been inferred.

A further implication is that, to increase the total output in the divergent situation, less likely solutions will have to be sought. If there is a difference between the two categories, the difference lies in the strategy of seeking many different answers to the divergent question, but this is less a mental operation on the available information than it is a search for alternatives. As noted before, this suggests that divergent thinking is more a style than a separate mental operation.

It should also be clear that a sizable amount of prior information regarding the problem is needed by the student before he can successfully deal with the question, in either the convergent or divergent framework. Thus, while memory is independent from divergent and convergent thinking in the Guilford model, it is rarely or never independent in the solution to a specific problem. This is the real reason for the high intercorrelations found between the major thought categories in classroom expressiveness.

The role played by evaluative thinking should not be overlooked in the two solutions to the balloon question. In the answer to the convergent question, the appropriateness of each step must be weighed in the reasoning process to see if it fits previous knowledge. Thus, the individual asks himself questions at each stage of thinking. "Is it true that the balloon's size is determined by pressures on its surface? Perhaps there is another way. No! This is the most reasonable answer. Continue with your reasoning." In the divergent question, a student applies evaluative thinking in determining the number and kinds of responses he will report to the questioner. Consider the following line of thought: "Perhaps there is a little man inside the balloon alternately stretching and folding his arms. Should I report this as one of my solutions or not?" The evaluative decision not to report such far out solutions will reduce the student's score on divergent thinking. No wonder there is reported a relationship between divergent thinking and mental playfulness! Another way of looking at mental playfulness is that it represents a disinterest in applying strict evaluative standards to the output. The humor of the ridiculous is of a similar stripe.

One conclusion of this study is that the model of the structure of intellect is incorrect when commonly pictured as a cube with independent categories of cognition, memory, divergent thinking, convergent thinking, and evaluation across the operations dimension. Even in a laboratory situation, an intimate interrelationship appears among these mental operations, obscured only by the special nature of constructed tests and the particular methods of analysis used to develop the model.

Some thought has been given to an alternate model to portray the thinking operations involved in problem solving. Potentially fruitful sources for such a model are analogies drawn from computer operation, even though these analogies have limitations in direct application. The human thinking apparatus goes through a complex maturational process, undoubtedly changing the rules regarding information processing from one developmental stage to the next. Also, the human being is able to change his search techniques when standard methods do not apply. Nevertheless, it seems possible to divide thinking operations into four major dimensions roughly analogous to computer functions—storage, scanning, matching, and logical operations.

Storage refers to information stored by the individual in his complex memory system. This information includes facts, associations, and classes of objects or ideas that are retrievable on demand. Whether a fact is stored as an isolated bit of information or with many rich associations dramatically influences the retrievability of that information. Storage itself has been used as a measure of intellectual ability. Vocabulary tests are really measures of the semantic storage abilities of the individual. Schools have often placed heavy emphasis on storage in evaluation of a student's success.

A rather different type of mental operation is referred to by the term scanning, meaning skills used to search for relevant stored material to solve a particular problem. It can also refer, in an outward sense, to the style of search taken by the individual in seeking further needed information within the environment. Thus, a person faced with a question, "What is a Heffalump?" and having scanned his internal storage areas and found little response may then direct attention to a search for information from dictionaries, encyclopedias, zoos, and children's stories. What has been called divergent thinking in this study seems to represent a set of rules that govern a particular type of scanning, as in the tests requesting that large numbers of possible answers be given to a proposition or problem.

A complex relationship seems to exist between storage and scanning, since part of the information placed in the storage units of the human computer must be rules which influence or determine the type of scanning for various kinds of problems. This, in turn, creates a set which will influence future information processing. The influence of past input upon future input has been recognized by such psychological constructs as perceptual defense, cognitive dissonance, etc.

The third major area of cognitive operation could be labeled matching. In this operation, the individual is comparing various alternatives as to similarity or appropriateness to a given criterion. In the earliest developmental stages, matching refers to recognizing simple likes and differences. Later, a different kind of matching is used to determine whether or not a particular object or word belongs to a class. Still later in a developmental sequence, it is used to decide whether or not a series of events fits complex criteria of effectiveness. In this respect, matching closely resembles what is called evaluative thinking in the present study. Evaluative thinking can be performed for its own sake; it also can be involved in the problem solving aspect of the fourth major operation.

The fourth major operation refers to a general system of thinking under the heading of logical operations. The individual takes information given to him and applies certain systematic rules to generate a solution or conclusion. The development of systems of rules is described effectively in the work of Piaget (Flavell, 1963). Thus, while the type of problem depends upon the scanning operation, the procedure by which the individual generates a conclusion through logical thinking is termed a logical operation. As used in this study, convergent thinking represents most closely the area of logical operations, although the category of divergent implications and synthesis is also appropriate.

At the present time, it is the opinion of the investigators that all thinking operations can be included in these four categories to provide the basis for further analysis of data.

Cognitive Style. One of the possible links to be forged between the domains of personality and cognition lies in the recent rebirth of interest in cognitive style. Cognitive style may be defined as a characteristic set or way in which an individual responds to or approaches his environment. This includes characteristic ways of processing information.

Gallagher (1964a) pointed out that at least four investigators have been looking at cognitive style in terms of the willingness of the individual to take intellectual risks. Maslow (1956), Schachtel (1959), Witkin et al. (1962), and Getzels and Jackson (1962) have investigated and differentiated these styles. Maslow calls them defense and growth; Schachtel refers to autocentric and allocentric; Witkin et al. mention field dependent and field independent; and Getzels and Jackson differentiate high IQ and high creative. The basis for such styles seems to lie in the personality domain, yet the style reveals itself in cognitive performance.

In the present study, the findings on cognitive style were interesting enough to warrant further investigation. If classroom expressiveness is considered a style, some degree of consistency was found in students' expressiveness from one point in time to another, and from one classroom to another. This expressiveness also seemed to be related to certain attitudes and personality variables.

In the replication of Getzels and Jackson's work (1962), a number of expected results were obtained, particularly with the low IQ—high divergent boys. With this group, teachers were less favorable in their ratings on cognition, as predicted, while the high IQ—low divergent boys seemed better accepted by the teacher yet showed differences in attitudes toward concepts, especially Work, to which they responded negatively. These results suggest that while Getzels and Jackson, and Torrance (1959) have been severely taken to task for technical shortcomings in their research, they identified some cognitive style variables worthy of further exploration. The general description of the low IQ—high divergent youngster seems to hold, at least for the boys in the present study. There are differences in their attitudes, and teachers regard them less favorably than the youngsters called high IQ—low divergent.

The implications of these findings for education are something else again. One popular interpretation is that the creative (divergent) student is smothered by the traditional educational setting and discriminated against by the conformist teacher. Another interpretation, just as likely, is that the high divergent but not high IQ student is, in fact, unsuccessful as a learner and not particularly adept at mobilizing his scattered intellectual resources to attack a problem. The teacher then is merely calling them as he sees them when he says that the low IQ—high divergent youngster is not as good a thinker, since he is not, for most traditional classroom tasks.

Sex played a role in the differences obtained in cognitive style. The high IQ—high divergent girls were found to be significantly superior in classroom expressiveness, teacher ratings, and personality characteristics. The same was not true of the high IQ—high divergent boys. With the girls, high expressiveness and high scores on various instruments accompanied a general pattern of good academic adjustment and acceptance of the academic role. In the boys, there seemed to be more confusion and overlapping of roles. Some boys were expressive, apparently for academic gain, while others were expressive for self enhancement. Obviously, similar behavior may imply quite different motivational structures in boys than in girls. More thorough investigation is needed.

Sex Differences. An impressive literature has been developed over the last decade on the importance of sex as a variable influencing many aspects of behavior. The general results of the present study seem to be in harmony with previous work. The gifted boys seemed to enjoy more self confidence in their own abilities, while the gifted girls seemed to express more positive attitudes toward other people and concepts such as Mother, School, and Work. These differences in attitudes were probably established in early childhood. As Kagan (1964) pointed out in a recent review:

> The child as young as four has dichotomized the world into male and female people and is concerned with boy-girl differences. By the time he is seven, he is intensely committed to molding his behavior in concordance with cultural standards appropriate to his biological sex and he shows uneasiness, anxiety and even anger when he is in danger of behaving in ways regarded as characteristic of the opposite sex (p. 162).

Evidence has accumulated showing a variety of applications of this general theme. Torrance (1963) has shown that the number of ideas produced to improve children's toys was dependent on the sex identification of the toy in question. Primary school boys gave more ideas on improving a toy if it was seen as masculine and vice versa for the girls.

Crandall and Rabson (1960) found that boys were more likely than girls to return to unsolved puzzles, and to be more analytic, independent, and persistent in their approach to problems. Whether or not such differences are genetically or environmentally based, or represent a subtle blend of both influences, is less important for educational action than recognition that differences exist.

Although the girls in the study seemed on a par with the boys in written performance, they were less expressive in the classroom. It seems reasonable to conclude that the sex role identification of the girls had an inhibiting effect on their classroom expressiveness. As Kagan (1964) pointed out:

> It is not uncommon for an adolescent to view intense intellectual strivings as a competitively aggressive behavior. In order to obtain the best grade in a class, one must often defeat a peer in open debate and in examination scores. The competition has obvious aggressive overtones. Since the typical female has greater anxiety over aggressive and competitive behavior than the male, she experiences greater conflict over intellectual competition (p. 158).

If oral expressiveness is viewed as a positive trait for girls, it is clear that special steps will need to be taken to encourage it.

The Measurement of Creativity. Some of the measuring instruments used in the present study have been labeled creativity tests by other investigators. This is an overenthusiastic term, to say the least. It is like describing one piston movement in the gasoline engine and saying that one has captured the essence of the entire cycle.

Yet there seems little doubt that these tests are measuring something that is different from what is measured by standard IQ tests. It was suggested earlier that this something was a type of cognitive style. As other investigators found, a small correlation was noted between IQ and divergence, or fluency, or breadth, or whatever term may be given to the production of a large number of answers to a given question or proposition. Furthermore, this characteristic seemed reasonably stable within individuals. The best estimate of the project staff was that scores on divergent tests, particularly scores which take into account only total production, are really measuring one component, intellectual risk taking.

The role of evaluative thinking in such tests needs to be thoroughly investigated. The production of a long string of answers to questions such as, "What would happen if everyone lived to be 200 years old?" requires a certain suspension of judgment. Each answer projected can stir up a raft of self criticism with attendant objections or qualifications. Unless the person is willing to put these aside and go on to the next idea, he will not be productive on a timed task.

If it is true that temporary suspension of critical judgment is one necessary component for creative thinking, we can see how tests of divergence have a firm grip on one part of the mystical elephant, creativity. The new idea or original proposal tends to wobble and flutter intellectually like a wounded quail and hasn't a chance against academic marksmen whose great joy lies in bringing fledgling ideas down to earth with a sickening thud. Of course, the joke is on the critics, since eventually they shoot down their own new ideas with the same ferocity and are unlikely to produce new contributions of any consequence.

On the other hand, it is unlikely that the compulsive free association expert, who has dozens of ideas for every problem but cannot follow any one of these to conclusion or bring himself to evaluate which of many proposals might work, will produce much more than the critic who is always evaluating. The divergent tests may very well predict high creativity for such a person and be wrong, for the creative person must apply evaluation as well as suspend it, and the failure to do either can be debilitating to actual production. One of the best but least likely things that could happen would be for investigators to avoid assiduously the term creativity in referring to these embryonic measures.

The Classroom Environment. It has often been said, and said proudly, that teaching is an art. Indeed it is. It might serve a useful purpose for the education profession to consider in more detail precisely what that statement means. It seems to mean that we can observe, as a result of the efforts of the best practitioners, an extremely desirable product, but the means or process by which this product was obtained cannot be determined.

The implication is often made that not only has this teaching process not been measured, but that it cannot be measured. This viewpoint holds that some kind of mysterious magic creates a fortuitous blend of indescribable ingredients possessed by only a few fortunate practitioners. Training others usually consists of students sitting at the feet of the masters, hoping in some unpredictable way to absorb the magic skill.

This attitude, of course, is observed not only in the education profession. At various times, it has been stated that medicine is an art, psychotherapy is an art, etc. The individual brilliance of some practitioners of such arts in the past has not blinded these professions to the necessity of changing from an art to a science as soon as possible. Despite the brilliance of certain individual physicians, good medical service for most people has relied on scientific advances in a number of disciplines.

The situation in education seems parallel. Blessed with a teacher who has an intuitive knowledge of educational process, a few students receive manifest benefits. However, what about the other students, most of whom cannot be expected to meet this one-in-a-thousand gifted teacher? Our responsibility would seem to lie in making education less of an art and more of a science, by studying the processes by which desirable cognitive products are obtained.

One of the most powerful observations made as a result of the data collected in the present study was how central and crucial the teacher's role is as initiator and determiner of the kinds of thought processes expressed in the classroom. It was the teacher who asked the directing questions which were the focus of the discussion. The way in which these questions were presented determined the kind of thought operations the students performed. The tendency of the student to respond in the same idiom as the teacher was so strong that whenever it did not occur, the observer was left with the feeling that either the student did not understand the question, or something was grievously amiss in the rules governing teacher student operation in that classroom. A student, for example, could not respond to a question such as "Who were the three best presidents the United States has ever had?" without saying something that approached evaluative judgment. It is inconceivable to consider a student responding effectively to "What is the formula for nitric acid?" without giving a factual memory response. The same shaping role played by teacher questions has been noted by Taba et al. (1964).

> The questions teachers ask set the limits within which students can operate and the expectations regarding the level of cognitive operations. Questions are the carriers of whatever new cognitive system is emerging. Some questions function as invitations to heighten the performance of certain cognitive operations, while leaving the content in the direction of these operations open. Such questions invite invention, discovery, the creative use of previous knowledge. Others control and limit both the content and nature of cognitive operation (p. 177).

These observations place both a great responsibility and great opportunity in the hands of the teacher. It means that the teacher can direct, by questions, the flow and level of thought complexity in the classroom. It is our conclusion that this skill can be acquired by teachers if training is given in the system, and practice allowed in its application.

There is little doubt in the minds of investigators who have studied the teacher and the classroom that it is possible to measure, modify, and improve the teaching process. Medley (1963), discussing the OScAR technique (observation schedule and record), made the following statement:

> Perhaps the most important conclusion to be drawn from these two studies, is that meaningful measures of classroom behavior can be developed from objective records made by relatively untrained observers with a rather crude instrument . . . (p. 272).

Wallen and Travers (1963) suggested that it is possible to construct a model within which one can construct a law of teacher behavior. Their formula is: $T = f(R_g, R_l)$. T represents the behavior of the teacher, which is a function of the goals to be achieved, R_g, and the present behavior of the pupils, R_l. On the basis of experience in the present study, the means by which the goals are obtained, as well as the goals themselves, are important topics.

Project Limitations

Every research project has built-in limitations which restrict the interpretation of results and circumscribe the number and kind of inferences that can be drawn. In this study, many of the limitations are fairly obvious.

Sample of Subjects. One of the factors limiting the results was the type of subjects upon whom the data was collected. These students were intellectually gifted, with a history of successful academic achievement. There were no children of average or below average mental ability, nor were there intellectually superior underachievers. This limitation probably influenced the finding that IQ score was not a significant variable and may have been responsible for some of the limited relationships obtained between personality and attitudinal variables and classroom performance. One would expect that the majority of these youngsters would be moderately well adjusted, and thus there would be no negative extreme along the continuum of emotional disturbance and maladjustment.

Age of Subjects. The sex differences found may very well be specific to the age level of the youngsters studied. Between the ages of 12 and 16 there emerges a greater consciousness of sex role and this change could well have influenced and biased the results. It should not be assumed that similar results would be obtained on gifted, intermediate grade children or on senior high school students.

Teacher Sample. Any generalizations from this study regarding teacher behavior are limited by the small number of teachers involved and the fact that these teachers were specifically chosen to work with gifted students. An unselected group of teachers probably would show greater range and variance. Since the sample group showed impressive variance on most measurable characteristics, the conclusion is that teachers' performance, as categorized in the study, shows much variation from one teacher to another, although there is some consistency within the individual teacher performance.

Limitations of Classroom Recordings. The recorded sample of teacher and student behavior must be considered only one component of the whole learning environment. Not all, nor necessarily the most important, interactions between teacher and student occur in the classroom discussions. Perhaps the best teaching is done in individual conferences with students, through criticisms and suggestions in development of individual reports, or in the stimulation of personal research projects. While it is tempting to assume that the teacher style in these group discussions would imply certain kinds of behavior in individual contacts, this is not necessarily so and would have to be demonstrated.

Measuring Instruments. Every research study is, in the end, at the mercy of the measuring instruments. This project is no exception. One of the key instruments was the classification system devised as part of the total project. The classification system itself appears to be a potentially useful tool in describing teacher and student behavior and in categorizing differences among students and among teachers. One of the problems noted early by the judges was that the system might be too atomistic, too refined in its ratings to show accurately what was going on in the classroom. Thus, the detailed rating of each statement made by teachers and students sometimes detracted from the larger meaning and may, as a consequence, have been somewhat misleading. In the future, larger units of measurement should be developed to describe more adequately classroom interchange.

In addition to the classification system, the results were dependent upon tests of attitude, such as the semantic differential and sentence completion, and new tests of cognition, such as the divergent thinking tests, which attempt to measure a rather new dimension in intellectual performance. The reliability and stability of each of these measures has been questioned. The risk taken by the investigators was that, by using some measuring instruments which appeared to touch upon important variables, even though they had some technical weaknesses, real differences might have been obscured by the unreliability of such instruments.

Future Research Plans

In a program of research, the first study often serves its most important function in making clear what should have been studied if only the investigator had known at the beginning what he knew halfway through the first research problem. Although much useful information was gained through this project, the feeling persists that further analysis along a broader conception of classroom interaction, with improved measuring instruments, can bring forth greater returns in terms of insight into teacher strategies and the teaching process.

Further investigations have stressed larger units called topics, which can be identified and classified in a broader system. Hopefully, additional analysis of these classroom topics will provide even more meaningful information for teacher education.

Not all teacher or student behaviors are equally important to the conduct of the classroom or to the advancement of curriculum goals. There appear to be critical incidents, certain choice points, certain crossroads, in the sequence of the classroom activities. The decisions at these points have a shaping effect on the classroom operation. An attempt to locate such choice points is one logical extension of the present study. Informal content analyses of the tapescripts have already been undertaken. It is hoped that a classification of these various choice points will fit them into the larger topics.

Another categorization, the range of possible teacher choices in a given situation, and an attempt to explore the consequences of each choice may pay richer dividends for teacher education. At first, this would be done clinically by taking specific examples from tapescripts.

Although the results within the classrooms were only suggestive, there were hints that certain kinds of cognitive processes are called for more often in certain subject areas than in others. In science, the emphasis seemed to be on the close analysis of specific problems. Little attempt was made to explore a large number of different intellectual paths; instead, emphasis was placed on the analytic efficiency by which a person follows one line of thought. This seems to call for a review of teacher strategy, if, indeed, other cognitive goals are considered important. The scientific technician must be able to follow standard procedures, but the creative scientist must explore. A close analysis of a random sample or typical sample of effective teachers in a given content area would provide a general picture of expectations in cognitive expression.

The sex differences in the present study underline the importance of understanding the attitudes, values, and perceived sex roles of students in order to provide an effective educational environment for them. The results were sufficiently dramatic to suggest that a major research effort should be made in study of gifted girls. One line of investigation could compare public versus private performance on intellectual tasks. It seems obvious that intellectual aggressiveness is generally accepted as a male role. Girls who are able to compete in this area appear, on the basis of our present findings, to be the most mature, secure, and well adjusted girls. Does the inhibition of intellectual aggressiveness in public performance affect the private performance as reflected in term papers, individual research projects or compositions, or in other dimensions which allow a certain amount of social anonymity for the student?

A further study of attitudes and values of gifted girls would lead to a better understanding of their problems in modern society. Since gifted girls represent the largest single source of untapped intellectual power in our society, it seems important to devote more attention to analysis of their unique adjustment problems at all levels of the educational system.

MacKinnon (1962) and others have pointed out the seemingly paradoxical finding that creative members of both sexes appear more like the opposite sex in personality characteristics and attitudes. That is, creative men appear more feminine, while creative women appear more masculine. It seems likely that such findings relate to the general characteristics of openness to experiences, as opposed to a closed system where certain experiences and thoughts are denied the individual on the grounds that they arc inconsistent with the expected self image or concept.

This leads into the topic of cognitive style, or styles of information processing, and the impressive degree of individual difference in such styles. What family and social variables are relevant for creation of various styles? How do different types of instruction affect the growth or delay of these styles? The most stringent limitations are set by perceived sex role. One notes the contempt society holds for men who engage in the fine arts or the suspicion held for women who invade the physical sciences. Predominantly other-directed individuals are likely to shut themselves off from experiences identified as belonging to the opposite sex and thus reduce the number of effective concepts they can use in problem solving or creative thinking. Knowing the patterns of child rearing and later social experiences which result in the other-directed versus inner-directed adults could provide the basis for allowing greater creativity to the individual and the culture.

Despite the emphasis in the current study on interaction and complex social variables, the role of the laboratory in studying some aspects of the problems should be recognized. A prime example is the thinking operation or the thinking process itself. It is unlikely that much more will be derived from extended analysis of student responses to questions such as, "How many ways are there to use a brick?" or, "What would happen if pills were substituted for food?" Between the question and answer, much that goes unstudied takes place within the mind of the respondent. Intensive analysis of the chain of thinking between question and answer would be more to the point.

New techniques of computer simulation of thinking operations may be necessary to find out more about such processes as "insight." If insight represents a generalization about certain data, perhaps there is a critical mass (say 70 percent of necessary data dealing with the problem) which must be available to conscious manipulation before the insight comes. Such topics are more open to computer study than with human subjects since amount and kind of input to the computer can be controlled.

A Final Word

Many social scientists trained in experimental and research techniques yearn to have a neat, precise problem where a specific treatment is applied, appropriate control groups are available, all extraneous factors either eliminated or controlled, etc. Even the thought of studying the multitude of interacting factors in the classroom must bring a feeling of despair. If the results are dependent on the teacher, the phase of curriculum development, the personality and intellectual makeup of the group, numerous child developmental variables, and the time of the year, how meaningful is the talk about a controlled experiment?

Perhaps the closest approach to the problem would be to use one group as its own control and systematically introduce teacher variation such as different types of question asking behavior. While this would use the class and teacher as its own control, even such a simple plan is at the mercy of a number of variables, to say nothing about the generalizability of the findings.

Perhaps, at this point in time, the model for the social scientist who wants to study group interactions in complex social situations should be closer to that of the astronomer than the physicist. The astronomer is doomed to observe the universe and draw inferences from observations without being able to control or manipulate the variables. The physicist has opportunities to control and manipulate and is not burdened with such matters as the representativeness of the sample of matter in his experiment.

The rationale for studying the classroom does not rest in possibilities for elegant research design; rather, these are important matters influencing present and future generations. Each scientific area must work out its own destiny, its own methods, and its own theoretical models without blindly imitating older and more mature disciplines.

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